PHILOSOPHICAL TRANSACTIONS.

GIVING SOME

ACCOUNT

OF THE

Present Undertakings, Studies and *Labours*

OF THE

INGENIOUS,

IN MANY

Considerable Parts of the World.

VOL. XXXIV. For the Year 1726, and *Jan. Febr. March, April, May* and *June* 1727.

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TO

Martin Folkes, *Esq;*

Vice-President of the Royal Society.

Honoured Sir,

I Shall not, I presume, need any other Apology for prefixing your Name to this *Thirty Fourth Volume* of *Philosophical Transactions*, when I declare, that the Motive of my doing so was the same, which induc'd the greatest Man that ever liv'd, to single you out to fill his Chair, and to preside in the Assemblies of the *Royal Society*, when the frequent Returns of his Indisposition would no longer permit him to attend them with his usual Assiduity.

This Motive, Sir, we all know, was your uncommon Love to, and your singular Attainments in those noble and manly Sciences, to which the Glory of Sir *Isaac Newton*, and the Reputation of the *Royal Society* is solely and entirely owing.

That Great Man was sensible, that something more than knowing the Name, the Shape and obvious Qualities of an Insect, a Pebble, a Plant, or a Shell, was requisite to form a Philosopher, even of the lowest rank, much more to qualifie one to sit at the Head of so great and learned a Body. We all of us remember that Saying so frequently in his Mouth, That *Natural History might indeed furnish Mate-*

rials for Natural Philoſophy; *but, however, Natural Hiſtory was not Natural Philoſophy*; and it was eaſy for all his Friends to ſee, with what intent he ſo often us'd this remarkable Expreſſion. We knew his Love to the *Royal Society*, and his Fears for it. It was not that he deſpis'd ſo uſeful a Branch of Learning as *Natural Hiſtory*; he was too wiſe to do ſo: But ſtill he judg'd that this humble Handmaid to Philoſophy, tho' ſhe might be well employ'd in amaſſing Implements and Materials for the Service of her Miſtreſs, yet muſt very much forget her ſelf, and the Meanneſs of her Station, if ever ſhe ſhould preſume to claim the Throne, and arrogate to her ſelf the Title of the *Queen of Sciences*.

Theſe, Sir, were the Sentiments of that Illuſtrious Philoſopher, and his Authority alone would weigh a great deal with you, if the Solidity of your own Judgment did not convince you of the Truth of them. But I ſhall not offer here to draw your Character: It is ſufficient to ſay, that Mr. *Folkes* was Sir *Iſaac Newton*'s Friend However, while I avoid being troubleſome to your Modeſty, I beg leave to indulge my own Vanity thus far, to endeavour by this publick Application to perpetuate the Memory of that ſincere and conſtant Friendſhip, which has now ſo many Years ſubſiſted between you and me, who am, with the higheſt Eſteem and Reſpect, Sir,

Your moſt Obliged and moſt Faithful Servant,

J. JURIN, R. S. *Secr.*

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PHILOSOPHICAL TRANSACTIONS.

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I. De Salibus Alcalino-fixis, *Auctore* C. Neuman, *Chym. Prof. Reg.* Berolin. *R. S. S.*

SALIA præcipuum totius chymiæ fulcimentum conſtituere nemini ignotum, eorumque fundamentalem cognitionem illi, qui vere utile quicquam cum iis inſtituere & peragere in chymia cupit, præ reliquis, circa quas verſatur chymia, conſuetis materiis, comparandam eſſe, extra omnem dubitationis aleam poſitum eſt: Quod vero ad hujus modi veram fundamentalem cognitionem, neque materiarum, ope inſtrumentorum geometrico-mechanicorum, in minutiſſimis particulis commenſuratione, neque externa contemplatione cum artificioſiſſimis etiam microſcopiis inſtituta, imo nec reliquorum ſenſuum externorum auxilio pervenire quis poſſit, chymici diligentes & laborioſi nimium jam experti ſunt; ita ut hodie cum ſcientia hacce demonſtrativa, Deo favente, eo perventum ſit, ut ad huius ſubjecta pariter & objecta, experientia infallibili comprobata, cenſenda & dijudicanda, illa, quæ ante multos annos irrepſit, ad alias forſitan ſcientias ſatis idonea, ad noſtram vero, licet docta valde & ſpeculativa apparens, tota inepta & minus ſufficiens philoſophia corpuſcularis, & per eam inſtitutæ mechanico-phyſicæ conſiderationes & ratiocinia, penitus nunc abrogata ſit & deleta. Hujus in locum (juxta effatum Senecæ: Veritas eſt ſimplex) alia, primo licet intuitu ſimplex viſa, attamen veritate & experientia ſuffulta, fallere neſcia, & unicuique comprobata methodus, ad chymica dicta phænomena dijudicanda conſtituta eſt, quæ veram & internam na-

turam partium conſtitutivarum, quæ in omnibus a Deo creatis, & quæ noſtra hæc ſcientia ſibi vendicat, corporibus mixtis reperiuntur, clariſſime, quouſque humani ſcilicet ingenii limites pertingunt, enucleatam & intellectui perviam exhibet. Adeo ut quilibet, ope hujus ab experientia profectæ theoriæ, lætus ſe munitum ſentiat, non modo obvias quaſlibet materias naturales, abſque dubii cujuſvis ſuſpicione clare cognoſcendo & dijudicando, verum etiam eaſdem, chymiæ auxilio, diverſimode reſolvendo vel combinando, aut nova mixta iterum producendo.

Cum vero in meis laboribus (quibus per viginti novem jam annos incubui) nec meliorem, nec magis ſufficientem viam, quam illam modo memoratam, ſine ulla præconcepta opinione viderim atque expertus ſim; itaque hancce hic congeſtam & propria experientia fundatam *de Salibus Alcalino-fixis* deſcriptionem, & quicquid de iis ſcire quam maxime refert, dicta methodo proponam: Nec minus etiam illas cum hiſce concurrentes materias, phænomena & præparata eatenus dijudicabo, quatenus ſapientia divina me hiſce donavit hucuſque, & quatenus reliqua mihi mandata multifaria negotia permittent. In quibus omnibus unicuique ſuam, in materia hacce, cum mea diſcrepantem opinionem lubens relinquam, hiſce conſiderate declaraturus, me ſemper aliorum opinioni calculum adjecturum, modo illa, magis quam mea, experientiæ reſpondens, me penitus convincat.

I. *De horum Salium Etymologia.*

Mixta illa jam conſideranda ut plurimum *Salia Alcalina*, *Salia fixa*, vel *Salia Lixivioſa* appellantur. 1. *Salia Lixivioſa* audiunt, quia per elixationem acquiruntur. 2. *Salia* vero *fixa* dicuntur, quoniam maxi-

ma

ma ignis vi nec volatilia redduntur, neque in ſublime feruntur vel abiguntur. 3. Quicquid per *Alcali* denominationem intelligitur, non adeo ignota etiam res eſt, nempe oppoſitum acidi, vel quod idem eſt, *Antacidum.* Origo autem nominis hujus ab arabico *Alcali* derivatur; *Kali* ſignificat Sal, & *Al* præfigitur, quemadmodum in Gallica lingua articulus definitus *le*, *la*; itaque *Al Kali* conjunctim *le Sel* denotat. Notum inſuper eſt, quod & herba quædam reperiatur, *Kali* dicta, in locis maritimis creſcens, multoque ſale ſcatens, à *Lobelio* etiam *Soda* nuncupata, quæ ſi comburitur & elixatur, ingentem ſalis copiam præbere ſolet, quod olim ſimpliciter *Sal* adjecto Arabico nomine *Alcali* appellatum fuit. Cumque hoc ipſum Sal combuſtioni etiam aliarum herbarum & vegetabilium forte anſam dederit, & ſales inde prolecti ejuſdem fere indolis & naturæ reperti fuerint, credibile admodum eſt, veteres, modo dicti ſalis originale nomen ideo retinuiſſe, & hoc illudve æque *Alcali* appellaſſe, & tantum tractu temporis, ad meliorem diſtinctionem, hoc vel illud cognomen adjectum forſitan fuiſſe, ita præter *purè Salia Alcalia*, corpora etiam *terreſtria Alcalia* innotuere; prioribus, pro noſtro nunc ſcopo nobis inſervientibus, ad diſtinctionem terreſtrium, latinam denominationem *Salis* adjecerunt, & hocce in aqua ſolubile mixtum *Sal Alcali*, vel in genere *Salia Alcalia* appellarunt, ne forte ſola vox *Alcali* æquivoca evadat, vel ad ſignificationem ambiguam, inter *Salinum* vel *terreſtre Alcali*, occaſionem præberet.

In genere autem de adpellatione monendum, non ſatis exprimendi efficacem eſſe denominationem, ſive ſolùm *Salia Alcalina*, ſive *Salia fixa* ſolùm vocentur, quoniam utrumque nomen ſenſum iterum ſuggerere poteſt æquivocum: etenim primo habemus *& Salia Alcalia volatilia*, & ſecundo *Salia fixa*, quæ non *pure*

Alcalina, ſed *Salia* dicta *Neutra* conſtituunt: Quamobrem ſecurius erit, præparata iſta nunc conſideranda ambobus ſimul inſignire nominibus, puta *Salia Alcalina fixa* eadem appellare.

Ceterum nobis ſufficit ſcire, quod voce *Alcali* oppoſitum *Acidi*, per nomen *fixum* vero aliquid, quod conſtans in igne ſit, & per maximam ignis torturam, ita per ſe, non penitus deſtrui vel auferri poſſit, intelligatur, & quod in toto orbe, a multis retro ſeculis, in hodiernum uſque diem uſui ceſſerit, ſalia ejuſmodi, ad diſtinguendum voces in chymia, ita nuncupare & ab aliis ſalibus diſtinguere. Parum denique refert chymico practico, num voces ejuſmodi Arabicæ, vel Chaldaicæ, vel alii omnino linguæ originem debeant, modo verſus alios artis peritos loquendo vel ſcribendo mentem ſuam explanare poterit.

Originarium Alcali hodie quidem adhuc conficitur, ſed non ex unica herba *Kali* vel *Soda* tantum, ſed ex aliis ſimul ad maris littora creſcentibus, nec ſale deſtitutis herbis. Cum vero maximam partem ſalis hujus ſoda vel *Kali* forſitan porrigat, ideo ſub nomine ſodæ, & cum copioſiſſime in Hiſpania alitur & præparatur, ſub cognomine *Sodæ Hiſpanicæ* exportatur, venditur & conſumitur.

Quemadmodum vero *Kali* hocce non parum de ſale marino participat, cum quo, uti dictum, & aliæ herbæ permiſcentur, totaque incineratio & ſubſequens præparatio non adeo circumſpectè, ſed ſolummodo ab hominibus plebejis ejuſmodi locorum accolis peragitur; itaque ultro apparet, quemadmodum & re ipſa conſtat, *Alkali* hocce vel ſodam minime purum chymicum, ſed aliis ſalibus & impuritatibus, ut & abundanti terra conſpurcatum Sal Alkali exhibere: Quare & noſtris hiſce temporibus nec chymiæ, neque medicinæ, ſed ſolummodo mechanicis artificibus & opificibus,

bus, maxime vitriariis, ſaponum confectoribus & tinctoribus inſervit. Si quis vero, hiſce non obſtantibus, illo ad chymicos labores uti vellet, tunc depuratione neceſſaria & ſeparatione earum, ad Sal Alkali purum haud pertinentium, impurarum & peregrinarum ſive admixtarum, ſive caſu introductarum rerum omnino indiget. Hæcce omnia, occaſione originis vocis Alkali, paucis præmittere volui, ad proprium ſcopum nunc reverſurus.

II. *Ex quibus Salia Alcalina fixa pura ſint cognoſcenda, & quibus proprietatibus gaudere debeant.*

Sal Alkali fixum purum primo quatuor proprietates Alkali, cujuſdam in genere poſſideat neceſſe eſt, quibus & ſalia Alcalino-Volatilia ſtipata ſunt.

1. Ut cum acidis quibuſvis efferveſcat.
2. Ut cum acidis hiſce in Sal medium abeat.
3. Ut omnes cum acidis factas ſolutiones præcipitet.
4. Ut cœruleum ſyrupi violarum colorem in viridem tranſmutet.

Sal Alcali fixum contra in ſubſequentibus proprietatibus a volatilibus Alcalicis ſalibus quam maxime diſcrepat, nempe quod

1. Solutionem Mercurii ſublimati non in album, quod ſalis Alcali volatilis indoles eſt, ſed in fuſcum, citrinum colorem præcipitet.
2. Cum cupro adjecto nec veſtigium coloris cœrulei excitet.
3. Cum Spiritu Nitri fumum haud producat.
4. Aquæ admixtum, non frigoris, ſed potius caloris ſenſum illi conciliet.

5. Ab

5. Ab aere admiſſo haud ſiccum relinquatur, ſed humidum evadat, vel denique liqueſcat.
6. In igne non avolet, ſed permaneat, candeſcente ſuaviter igne fere nihil, ingenti vero & fuſorio, parum admodum de pondere ſuo amittat.
7. Non ſolum in igne fixum perſeveret, ſed etiam cito ſe fundi patiatur, & denique
8. In Cryſtallos haud abeat quemadmodum ſalia nonnulla volatilia.

Præterea Sal Alkali fixum purum, etiam ſubſequentes qualitates peculiares poſſidere, & in tentaminibus monſtrare debet.

1. Ut in forma ſoluta, cum alio, circa quod occupati ſumus, puriſſimo ſale Alcali fixo, abſque ulla alteratione, turbatione vel præcipitatione, amicabiliter coëat neceſſe eſt.
2. Ut Sulphur in humida via, æque ac ſicca, omnino ſolvat oportet.
3. Cum Acido vitriolico puro permixtum, & in ſal medium cryſtallinum coactum, in igne nihil ponderis ſui amittere, nec ullo modo fluere debet.
4. Denique purum & genuinum ejuſmodi Sal Alcali fixum, præter reliquas omnes antea recenſitas 15 proprietates, cum pinguibus etiam vel expreſſis oleis ſaponem conſtituere neceſſum habet.

Quod ſi vero in unico ſolum harum ſingularium commemoratarum proprietatum peccet, tunc ſtatim ſignum penitus infallibile eſt Sal Alkali fixum non purum fuiſſe.

III. *Quænam ſubjecta requiruntur ad producendum Sal Alcali fixum.*

Sicuti Chymia univerſa circa res pure Naturales verſatur, & in genere nil aliud peragit, quam reſolvere & combinare, nil quoque producit, ubi nihil exiſtit, ſed ſolummodo in hunc vel iſtum modum, de his jam dum præſentibus ſubjectis, nova omnino mixta, per tranſpoſitionem partium ut plurimum (ſive reſolvendo id fiat vel combinando) artificioſe producit, quæ natura, in ſe ſpectata, defectu inſtrumentorum, ſive nunquam, ſive tantum rariſſime exhibere poteſt; & ſic omnia ad naturæ nutum in Chymia peraguntur, licet difficile admodum ſit de omnibus & ſingulis caſu productis novis, veram & phyſicalem cauſam in inſtanti eruere. Ita de Salibus hiſce Alcalino-fixis in anteceſſum ſcire convenit, ea pariter naturali penitus & comprehenſibili modo fieri.

Quantum mihi innotuit, natura cum integro ſuo penu, nullum nobis ſatis purum ſeparatum, & cum recenſitis proprietatibus dotatum, Sal Alcali fixum porrigit, ſed exiſtit, ſi demonſtrabile aliquod reperitur, (qualecunque in toto orbe Sal Alcali nativum invenire & explicare poſſum) unice & ſolum in illo, cum ſale Acido jam permixto, communi vel marino ſale. Circa hoc vero conſiderari oportet, quod Sal Alcali fixum ejuſmodi,

1. Quia illud nunquam nulloque modo in ſtatu ſuo pure Alcalino, ſed ubique, ſive cum acido ſalis communis, vel etiam, quemadmodum in fontibus nonnullis ſotericis, cum Acido Vitriolico conſpurcatum reperitur; ſi denique illud demonſtrare cupio, (poſito me hoc demonſtraturum)

variis-

variis nihilominus artificiis ab admixtis ejuſmodi rebus liberari prius debet; ita ut talia, artificioſis laboribus educta corpora, (certo reſpectu) haud ſimpliciter pro pure nativis, circa quæ ars minime verſatur, declarare poſſim.

2. Quod hocce in Sale communi reperiundum Alcalinum ens, cum denique illud artificiis variis ſeparaverim & demonſtraverim, nihilominus cum antea recenſitis ſedecim proprietatibus perfecte haud congruens purum, ſed a ſale Alcali fixo vegetabili ordinario valde diſcrepans Alcali exiſtat. Ex quibus generaliter denique concludo, purum Sal Alcali fixum naturam minime nobis porrigere, conſequenter omnia Salia Alcalina pura tota Artis Producta eſſe.

Regnum Vegetabilium, vel hiſce adnumeratas res naturales, ſi non in totum, maximam tamen partem, pro ſubjecto & materia agnoſcunt, ex quibus in maximâ copia produci & elaborari queunt; Nam licet hinc inde parum quicquam demonſtrativi, in Regno etiam Animali exhiberi quandoque poſſit, attamen, excepto illo, in urina & fæcibus a dicto ſale communi dependente, in tam parva quantitate exiſtit, ut attentionem haud mereatur. Rationem, quare tam parum, vel nihil Alcalino-fixi exibeat, ſuo loco, pro viribus, paucis ſubjungam.

Mirum interea videtur & paradoxum, quando de origine & exiſtentia Salis Alcali dicimus, produci illud ex re quadam, quæ nec granum Salis Alcalino-fixi continuit; quemadmodum ex omnibus iſtiuſmodi rebus, ex quibus multæ libræ imo centenarii Salis Alcali fixi eliciuntur, ante operationem in igne, vel ante incinerationem vel combuſtionem, nec granum hujuſmodi, in tentaminibus ſingulis probati Salis Alcalini

calini ad ſenſum educi poteſt; ſed ſi ſalini aliquid detegitur, ad acidam potius, quam Alcalinam naturam verget.

Majorem multo attentionem ſibi vendicat paradoxum hocce, ſi quis multa, ne dicam plurima, alia præparata Chymica conſucta cum hiſce comparat, in quibus ſingulis apparet, quod illud, quod Chymicus eduxit, antea jam in ſubjecto extiterit, & in illo ſolummodo extenſum, aliiſque rebus permixtum fuerit; conſequenter ab artificibus ſolummodo a permixtis ſeparatum, ſicque collectum, non productum, ſed eductum, nec de novo creatum vel compoſitum, ſed ſolum extractum vel ſegregatum fuiſſe; quemadmodum, exempli loco, in oleis eſſentialibus & expreſſis, in illis ope balnei eductis vegetabilium aquis, ſalibus eſſentialibus, ſpiritibus mineralibus, multiſque aliis rebus videre eſt: Verum illud ipſum de permultis aliis, & quidem proprie chymico-artificialibus rebus, *ex. gr.* de ſpiritu vini, ſpiritibus inflammabilibus, quibuſvis acetis, &c. & eadem quoque ratione de Salibus Alcalinis tam fixis, quam volatilibus, item de oriundis exinde ulterius novis mixtis, ut ſalibus ammoniacalibus, ſaponibus & ſimilibus aliis, dici nequit; ſi quidem de omnibus his rebus, & ſic etiam de Sale Alcali fixo, in ſubjecto ex quo id præparatum fuit (ut antea jam monui) ne micula quidem ejus antea in ipſo reperiri potuit, unde quoque Sal Alcali Fixum non eductum, ſed revera *productum* & *artificiale* exiſtit.

Præcipuum & maxime neceſſarium inſtrumentum ad productionem Salis Alcalino-fixi eſt IGNIS, utpote in quo prærogativa artis præ natura in tantum conſiſtit, dum hunc pro lubitu & placito excitare, minuere & augere, variaque corpora cum ipſo reſolvere & componere valet, quomodo & quando ipſa cupit: & cum hoc, nempe quod Salia Alcalino-fixa mediante

igne producantur, quidam Chymici verbales forte audiverint, hi derepente nudum inſtrumentum pro materia Salis Alcalini, vel pro principio conſtitutivo ipſo venditarunt, & univerſam Salis Alcalino-fixi formationem particulis ignis adſcripſerunt, cum tamen quotidiana experientia plane diverſum, & quod ignis undique tantum ut inſtrumentum ad ejus formationem cooperetur, viſibiliter convincat & demonſtrat, prout & ipſe in ſequentibus de hac re ulterius mentem meam ſum explicaturus.

Subjectum, ex quo Sal Alcali fixum produci debet, proprie duo neceſſaria requiſita vel ingredientia contineat, neceſſe habet, quæ ad conſtitutionem hujus ſalis abſolute requirantur, nimirum ut,

1. In ſe ſit inflammabile, & oleoſis vel bituminoſis partibus, &
2. Sale quoque acido dotatum.

Quod ſi ergo has abſolute & neceſſario requiſitas proprietates in uno ſubjecto conjunctas reperio, tum ſatis quoque ſufficiens eſt, ut Sal Alcali-fixum largiri queat, unde omnia fere vegetabilia, vel eorum partes incorruptæ, aptiſſima exiſtunt; uno vero utrorumque deficiente, parum quoque vel nihil Salis Alkali fixi inde emerget.

Hoc ergo fundamento omnis Salis Alcalino-fixi in mundo productio innititur, & pro diverſitate proportionis horum memoratorum duorum neceſſariorum ingredientium, etiam ex hoc vel illo ſubjecto modo plus, modo minus, modo debilius, modo fortius, vel alio modo diverſum Sal Alcalino-fixum acquiritur.

Sola ſiquidem oleoſi ingredientis copia omne punctum non abſolvit, dum & inprimis ſal acidum ut adſit, neceſſe eſt.

Quod

Quod ſi ergo Sal Alcalino-fixum productūrus, de quodam vegetabili, ſive ſit herba, radix, lignum, cortex, vel quicquid ejus ſit, antea tantum per alios labores, per quos ſolummodo contentam in eo olei & ſalis acidi proportionem concludere poſſum, ſufficienter inſtructus ſum, tum in anteceſſum quoque judicare potero, an multum vel parum Salis Alcali fixi datūrum ſit: Quod ſi enim parum vel nihil olei poſſidet, parvam quoque Salis Alcali proportionem ſubminiſtrabit, & ſi parum vel nihil ſalis acidi contineat, vel acidum volatilius exiſtat, multo minus adhuc ſuppeditabit; unde poſterior hæc circumſtantia, plerumque in cauſa & culpa eſt, quod non raro ex magno cujuſdam ligni acervo, vel aliis vegetabilium partibus, parum ſalis Alcali erui poſſit; & ſicut indubitatum exiſtit, quod omne ſanum vegetabile partes inflammabiles contineat, ita contra multa ex iis, vel parum ſalis, vel etiam volatile & ſub incineratione plerumque diffugiens, ſal acidum continent.

Dari quoque poſſunt plantæ, ligna, radices & ſimilia, ſalis & olei ditiſſima, quæ vero, dum incinerari debent, propter nimiam aeris intercluſionem, tantummodo vaporant, & in carbones, non vero in cineres exuruntur; qua circumſtantia omne fere ſal acidum, quamvis ejus non parvam quantitatem contineant, (præcipue ſi vegetabile adhuc viride, & inſufficienter exſiccatum ſit) ſenſim ſenſimque exhalat, perparum reſtat, & omne quod remanet, cinerem in pauca, & Sal Alcali-fixum in longe minori adhuc quantitate ſuppeditat.

Res hæc demonſtrari poteſt, *ex. gr.* in Pinu, vel quovis ligno, quo communiter ad urendum utimur: Si ejus aliquot centenarii recipiantur, iique leniter aperto aere comburantur, ſufficientem cinerem, & ex his notabilem quoque ſalis partem nanciſcemur:

Si vero ejuſdem ligni totidem centenarii in parvos acervos conſtruantur, carbonariorum more, vel alio quoque modo, ligno apertus aer adimatur, ejuſque modo tantum ei permittatur, ut vaporare poſſit, breviter carbones conſueti exinde conficiuntur & quidem ea ratione, ne ulli carbones inflammantes, qui in igne, aperto aere, fumantem flammam edunt, reſtent; ejus modi puros carbones, ſi tum aperto aere incineres, eoſque in comparatione quantitatis priorum cinerum ponderes, demum Sal Alcali exinde modo conſueto, elixiviando ſepares, & itidem ponderes, hæc poſterior methodus immenſum quanto minus cinerum & ſalis in reſpectu prioris, quod ab initio ſtatim aere aperto incineratum fuit, ſuppeditabit. Nulla alia ex ratione, hæc ponderis diverſitas ex ejuſdem quantitatis ligno oritur, quam quod in confectione carbonum pleraque pars ſalis acidi, vel communiter ita appellati ſpiritus lignorum, in aerem aufugerit, quæ tamen neceſſariò ad conſtitutionem Salis Alcalino-fixi, tanquam primarium ingrediens, requiritur.

Conſideratu dignum eſt, quod pro acquiſitione cineris vegetabilis abſolute admiſſio aperti vel liberi aeris requiratur, quippe ſine quo nulla ratione cineres acquirantur, unde carbones, occluſo aere, etiam fortiſſimo & per aliquot annos conſtanter durante igne, ſemper carbones permanent, & nunquam in cineres rediguntur.

Nec minus notatu & obſervatu dignum eſt, quod inter carbones & ex eodem ligno confectos cineres, tanta occurrat differentia.

1. Sic ex carbone, quantacunque etiam aquæ copia, ne hilum quidem ſalis Alkalini elixiviari vel ſeparari poteſt.

2. Nullum

2. Nullum ne quidem fortiſſimum & potentiſſimum acidum ullum effectum in carbone exerit.
3. Nullus carbo cum vitro ſeſe miſcet, quæ ſingula tamen cineres præſtant.

Sed ut ad formationem Salis Alcalini, ſeu neceſſaria ad id conſtituentia revertamur, veritas & probatio meæ Theſeos ex pluribus adhuc momentis & circumſtantiis ulterius ſatis patet.

1. Recipiatur ejuſmodi putridum, carioſum & quaſi emortuum lignum, quod alias dum in decenti vigore adhuc exiſtit, largam ſatis lixivioſi ſalis quantitatem edere ſolet ; comburatur, elixivietur, & procedatur in omnibus eadem ratione, ac ſi ſanum lignum fuiſſet, & tunc tandem reſpiciatur, & computus ducatur, quam parum vel nihil Salis Alcali-fixi exinde proveniet. Ratio eſt manifeſta, quia neceſſario ad ejus formationem requiſitæ, tam oleoſæ, quam præprimis quoque acidæ ſalinæ partes antea in aerem exhalarunt & evanuerunt.
2. Aſſumatur planta recens, quæ manifeſto ſufficiente ſalis acidi quantitate à natura dotata eſt, ſeparetur exinde ſal acidum, ſeu ita dictum ſal eſſentiale, quo facto herba exſiccetur, (ſeparato nimirum ante dicto ſale acido) comburatur & elixivietur cum omni cautela, tunc ad oculum patebit, quam parum vel nihil Salis Alcalino-fixi ſuppeditatura ſit.
3. Eadem autem herba, eademque quantitate aſſumta, abſque tamen ſalis acidi vel eſſentialis ſeparatione, tantum ſiccata, combuſta, & modo conſueto ita elixiviata, viſibiliter & aperte per auctiorem Salis Alcali fixi quantitatem, in comparatione

paratione prioris operationis, veritatem demonſtrabit.

4. Vel accipiatur ante extractum ſal eſſentiale acidum, calcinetur debita cum cautione, tum eadem certitudo emerget, & ex eo quoque, quia ejuſmodi ſalia eſſentialia non pure ſalia acida, ſed etiam aperte oleoſis & ad formationem Alcali altera ex parte neceſſariis partibus dotata ſunt, verum ſal Alcali fixum apparatur.

5. Quod ſi porro eadem recentis ejuſmodi herbæ quantitas, quæ ordinario bonam ſatis Salis Alcalini portionem dare ſolet, aſſumatur, factaque ponderatione tota quantitas in duas partes accurate dividatur, ejuſque pars dimidia ſiccetur, comburatur, & modo conſueto Sal Alcali fixum porro exinde elixivietur, ponderetur & conſervetur; altera vero pars dimidia ad putrefaciendum reponatur, & decenter tractetur, quo penitus penituſque putreſcat, tum deſtilletur, ita acquiremus, prout non incognitum eſt, ſpiritum urinoſum, ſal volatile & oleum empyreumaticum; ſed reſpiciatur poſtea, quantum Sal Alkali fixi ex reſiduo jam extrahi poſſit, ſi quidem certo, licet ſumma cum cautione elixivietur, perparum & ſæpe plane nihil emerget; ratio iterum non obſcura eſt, quia requiſita ad fixum Sal Alkali, ſal acidum & oleum, durante putrefactione metamorphoſin paſſa, & partim in ſal volatile, vel ſpiritum urinoſum converſa, partim etiam, & quidem pleraque ex parte, in oleum in ſubſtantia & forma olei per deſtillationem inde ſeparata fuerunt.

6. Quod ſi ad manus ſit purus citri ſuccus, qui aperte ſal acidum, aut paucas vero oleoſas, vel de principio inflammabili participantes partes

ſimul

ſimul continet, ejuſque magna ſatis portio, ad 20, 30, vel plures congios aſſumatur, aquoſum evaporetur, inſpiſſetur, comburatur & elixivietur, tum exinde quoque formatio Salis Alcali fixi manifeſta reddetur.

7. Quam optime autem ſenſibus noſtris hæc patebunt in tartaro, vel ejus cryſtallis quoque, quippe qui, prout unicuique notum eſt, nihil aliud, quam ſal acidum permultis oleoſis partibus imbutum, continet; quod ſi ergo hæc duo hic conjuncta requiſita primaria, nempe ſal acidum & oleum, mediante neceſſario ad hoc inſtrumento, ignis ſcilicet, uſtulentur & comburantur, tum ex reſiduo nullum amplius apertum ſal acidum, è contra vero de novo utique productum Sal Alcali, & quidem copioſe acquiritur; & ſic cum omnibus ſubjectis demonſtrari poteſt.

Quod vero oleoſa quoque ſubſtantia non parum de ſuo contribuat, inter alias diverſas demonſtrationes, (quas, niſi de induſtria nimiam in hac re prolixitatem evitarem, adducere poſſem) etiam ex unica hac cuique facile in ſenſus cadente circumſtantia colligi poteſt; quod ſi *ex. gr.* quatuor libræ ſiccati abſinthii incinerentur, & ex lixivio Sal fixum colligatur, accipimus præter propter 2 ½ uncias Salis Alcali fixi. Jam vero recipiantur itidem 4. libræ ejuſdem abſinthii, contundantur, & conſcindantur eæ, & pars ipſius oleoſa bituminoſa, ſeu reſinoſa, per ſpiritum vini rectificatiſſimum, quamdiu ſcilicet ſpiritus tingitur, extrahatur; tum plurimum quidem, non tamen omne & univerſum in eo contentum inflammabile educes, omne tamen ſalinum in ipſo interim remanet; quod reſtat poſtea, exſiccetur, comburatur, ſal exinde elixivietur & ponderetur, tum loco ante dictarum 2 ½ unciarum

ciarum jam unica tantummodo ſalis uncia prodibit; ex quo ergo iterum apertiſſime neceſſarium, ſub priori combuſtione relictum, & ad majorem Salis Alcalini fixi portionem contribuens, in poſteriori vero antiproba, mediante extractione ſpirituoſa ſejunctum, & jam proinde abſens, ingrediens bituminoſum ſeu oleoſum demonſtratur. Pro ulteriori demonſtratione, hæc jam memorata, ab extractione ſpirituoſa reſidua, remanentia per aquam excoquatur, herba tum reſtans exſiccetur, comburatur, elixivietur, ejuſque ſal colligatur, tum ejus tantummodo 19, vel 20 grana acquirentur; ratio eſt, quia ex his 4. herbæ libris jam omne fere oleoſum & ſal acidum, quæ ad compoſitionem & formationem Salis Alcalino-fixi requiruntur, extractum fuit.

IV. *Quomodo Salia Alcalino-fixa oriantur, & ex quo conſiſtant?*

Cum ergo clare ſatis pateat, quod ad formationem Salis Alcalino fixi acidum & principium quoddam inflammabile abſolute requirantur, prout comprobavi, pro primo facile exinde quoque colligi poteſt, quod aliquid ex his 2. tam neceſſariis ingredientibus ſimul in eo reſtare debeat, prout & revera reſtat.

Ignis, qua inſtrumentum, quod ad confectionem Salis Alcali adhibendum eſt, nihil aliud peragit, quam quod,

1. Omnem ſuperfluam aquam,
2. Omne itidem ſuperfluum ſal acidum in forma ſpiritus,
3. Volatile demum & ſuperfluum oleum ſeparet.

Quemadmodum igitur omnia ſalia, ſive acida, ſive alcalina ſint, ſeu quoquo modo appellentur, nec minus

nus omnia inflammabilia *terram pro baſi vel fundamento* agnoſcunt, quæ terra imprimis oculis ſeſe ſiſtit, ſi ejuſmodi mixta magis magiſque à connexis cum ea volatilibus partibus liberantur, & contra ad magis magiſque fixum ſtatum reducuntur: ita hoc quoque hic in generatione vel compoſitione Salis Alcalino-fixi videre licet; dum enim ignis ſenſim ſenſimque aliquid de volatiliori inflammabili & ſale acido cum aqua propulit, uno eodemque tempore, reſiduum magis fixum tam ſal acidum, quam bituminoſum magis magiſque concentratur, quando ſenſim ſenſimque neceſſaria ad conſtitutionem ſalis acidi aqua perit, quæ mediante calore ignis, ex ſale acido liberatur, & exhalare cogitur; eodem, inquam, tempore ſeparatur, altera ex parte, terra, quæ in ſale acido fuit; quo diutius ignis continuatur, vel ſubjectum incineratur, eo plus aquæ ſubtilis, ſubtilis acidi & inflammabilis abigitur, & tanto plus altera ex parte terræ acquiritur, vel tanto facilius degenerat ſal acidum cum pauca phlogiſti portione, in terram: Unde *maximum volumen ſalis fixi ex pura terra conſiſtit*: verum quia hæc terra originem ſuam ex ſale acido educit, &, ut ita loquar, naturæ acidæ eſt, impoſſibile eſt, quod etiam ſub prima incineratione vel calcinatione omne ſal acidum ex ipſa liberari poſſit; ſed ultimum potius maxime concentratum &, in comparatione prioris multo volatilioris, jam maxime fixum, ut & magis fixum ſubſtantiæ inflammabilis in quavis particula hujus terræ impactum reſtat & inhæret. Salinum hoc cauſa exiſtit, quare omnis hæc terra diſpoſitionem *ſolubilitatis* cum aqua retinet, & paucum illud, quod ex inflammabili ortum deducit, cauſa hic quoque eſt *cauſticitatis*, ſecundum proportionem & modum immixtionis ſui.

Ex eodem quoque fundamento, quia ſcilicet hæc terra acidæ naturæ & familiæ eſt, prodit quoque con-

ſtans quaſi deſiderium, ſal acidum rurſus aſſumendi, quod ipſorum *affinitas & intima commixtio cum omnibus acidis*, quin imo nuperrime à me demonſtratus magneſiſmus, quo Salia Alcalino fixa acidum quoque ex aere attrahunt, tanto magis confirmat. Hoc quoque concentratum & reſtans paucum ſal acidum, ut & hæc ad ſalinam mixtionem prona & jam ab omni aqua liberata terra, aperte unica exiſtit cauſa, quod hæc mixta id rurſus quaſi concupiſcant, quod per calorem ignis amiſerunt, nempe aquam: inde oritur celeris illa & ſubitanea extractio humiditatis & *ſolutio per deliquium*, quin & *incaleſcentia* illa, quod ſi fortiter combuſta fuere, & tum prima vice humiditatem ſentiunt quin etiam ipſa *incenſio*, ſi minerale quid ſimul adhibitum fuit, quale quid in *ſale Tartari cauſtico cum Regulo Antimonii Martiali* præparato, ut & *pyrophyris* videre licet.

Quod ſi vero Salibus Alcalicis paucum hoc ſal acidum & inflammabile plane adimitur, tum *nuda* tantum reſtat *terra*, quæ nec in aqua amplius ſolvi poteſt, nec humiditatem nec acidum ex aëre attrahit, nec incaleſcentiam producit & in omnibus quaſi emortua apparet; quamquam Chymicus, dummodo ipſi lubeat, eam rurſus, [ut ita dicere liceat] revivificare, & ad diſpoſitionem ſolutionis & mixtionis cum aqua, imo ad p eraſque priores qualitates reducere valet.

Omne quicquid de formatione Salis Alcalino-fixi ſuperius attuli, unico exemplo aliquatenus jam ſupra memorato plenarie demonſtrare poſſum, vel quivis illud in propriam ſui convictionem imitari poterit: Recipiatur ſal eſſentiale Acetoſellæ, quod viſu, guſtu, tactu, vel quoque modo ante examinatum, [quamvis nemo quoque iſtud negaturus ſit] apertum ſal acidum, non tamen purum, ſed particulis oleoſis mixtum, ſiſtit.

Quod

Quod ſi ergo hujus *e. g.* uncia 1. aſſumatur, ea cum aqua uniatur, tota ſeſe penitus in aqua ſolvit, prout etiam ex ſolutione aquoſa in cryſtallos antea concrevit, & ne minimum quidem indiſſolutum vel cum aqua permixtum reſtat, ita ut nec oleum, nec terra, nec Sal Alcali, nec aliud quicquam peregrinum, ſed nihil aliud, quam pura ſalis acidi ſolutio videri poſſit. Jam recipiatur porro 1. uncia ejuſdem ſicci tamen & cryſtallini ſalis, imponatur ea vaſculo retorto vitreo, & debita cum cautela, igne per gradus adhibito, deſtilletur, tunc ſenſim ſenſimque omne iſtud, quod antea in ſuo ordine circa confectionem Salis Alcali recenſui, jam hic mediante ignis inſtrumento, quod nihil aliud quam vaſculi retorti & contenti in eo ſalis incaleſcentiam cauſatur, eveniet & producetur.

1. In vas recipiens ſuperflua, quæ tamen in ſicco ſale antea latitarunt, aqua & oleum cum ſubtiliſſimo & volatiliſſimo ſale acido prodibunt.
2. E contra non parum terræ inde rurſus ſeparabitur, & reſiduum, cui aliquid ſalis concentrati & olei quaſi fixioris ſeſe innexuit, in perfectum Sal Alcali fixum degenerabit.

Invenientur circiter 3. drachmæ aquæ pauco ſale acido volatili imbutæ, qui liquor alias, ſpiritus acidus Acetoſellæ vocari poteſt, ſcrupulum forte unum olei empyreumatici ponderabis, & in vaſculo retorto, ita dictum reſtans caput mortuum conficiet circiter 4 drachmas & 20 & aliquot grana, ex quo plus quam 3 drachmas veri ſicci ſalis Alcali fixi elicies; ita ut pauca tantum grana exhalarint & diſperſa ſint, quæ de tota uncia, ſi ex omnibus computum traxeris, forte deficiant. Hic ergo omnia prodeunt & eveniunt, quæ

dixi; verum præter Sal Alcali &, quæ primo abiit, aquam & ſubtile acidum, oleum quoque adeſt, ut terra plane emortua, quæ duo poſteriora jam nullo modo cum aqua miſceri amplius volunt, quamvis antea, cum adhuc totum ſal acidum oleoſum conſtitueret, omnia in eodem ſolverentur.

Poteſt quoque Sal Alcalino-fixum deſtrui, parva illa acidi & inflammabilis portio ipſi adimi, indeque quantitas terræ augeri, & ſic unico hoc experimento omnium harum rerum certitudo erui.

Conſiſtit itaque Sal Alkali fixum ex terra quadam ſolubili, in quam, mediante igne, aliquid de fixiſſimo ſale acido ſeſe inſinuavit, ſimul quoque aliquid de magis fixo, vel ad terreſtreitatem magis inclinante bituminoſo, ſeu inflammabili principio, uſtulando quaſi innexum eſt, ita ut novum mixtum ſalinum, quod Chymici *Sal Alcali fixum* vocant, conſtituat.

Dominus *Homberg*, qui [prout Domino *D. Stahl* memoratum eſt] primum Pharmacopœus, poſtea vero [ut non nemini notum eſt] clariſſimus Chymicus *Lutetiis Pariſiorum* fuit, quem *Gallia* ad ipſius uſque tempus unquam habuit, hac in re, quamvis revera vir egregie habilis fuerit, tamen errorem paſſus eſt, dum ſal acidum tantum cognovit, quod ſeſe terreſtribus particulis innecteret, & ſic Sal Alcali fixum conſtitueret, de inflammabili vero nullam mentionem injecit.

Qui adhuc vivunt Senior Dominus *Geoffroi* & Dominus *Lemery*, tanquam duo præcipui hodierni *Galliæ* Chymici, in tantum quidem ſub ſuis laboribus obſervarunt, quod aliud quippiam adhuc præter ſupra dictum ſal acidum & terram, nempe aliquid de principio inflammabili ad conſtitutionem Salis Alcali neceſſario requiratur; ſed boni iſti viri rurſus in eo defecerunt, dum hoc inſtrumento, ſeu igni, aſſignare

voluerunt, cúm tamen in iſto ad Sal Alcali fixum adhibito ſubjecto vegetabili, reale ac ſubſtantiale ingrediens oleoſum vel bituminoſum uniuſcujuſque oculis obverſetur. Porrigatur quæſo his Dominis ejuſmodi ſubjectum in manus, in quo antea nullæ actuales partes inflammabiles demonſtrari vel conjecturari poſſunt, ſed in quo tantum ſal acidum & partes terreſtres probari queunt; hoc ſubjectum ipſi poterunt in vaſe retorto, per 20 & plures annos, cum multis centenariis extrorſum vaſi retorto adhibitis, particularum ignis & materiarum luminis [*Parties de feu. & matieres de la lumiere*] vel qua ratione ipſi volunt tractare, ea tamen cum expreſſa præcautione, ne cineres ipſos harum adhibitarum inſtrumentalium materiarum ignis addant, dum certo certius ſit ipſos ne unicum quidem granum Salis Alcalino-fixi exinde philoſophando eductúros, licet etiam totum *Carteſium* ſimul igni conſecrarint: jam vero ſi ex ipſorum opinione ignis ingrediens, vel conſtituens materiale ipſius exiſteret, neceſſum foret, ut abſolute etiam ex ejuſmodi rebus, in quibus in ſe nullæ eſſentiales partes inflammabiles præſto & immixtæ eſſent, illud conficere poſſint: Quod ſi in actum deducere non poterunt prout revera non poterunt, ſed ſemper materia in & ex ſe ipſo inflammabilis aſſúmendá venit, quare non ipſas actu realiter præſentes adhibitas, plane certas & demonſtrativas res, tanquam cauſam reſpiciam, vel quare memet huic & illi Philoſopho vel Chymico cerebrino, qui forte per totam ſuam vitam nullum carbonem manibus tractavit, & chymica ſubjecta & hiſtorias non ex ipſorum intima qualitate, & realiter conſtituentibus materialibus partibus diverſarum in iis contentarum materiarum, ſed tantummodo ab extra, mediante circulo, linea, & microſcopio, vel etiam quæ cum iis dimenſurare & perſpicere

perſpicere non poteſt, ſecundum propriam chymericam in cerebro tantummodo propoſitam, & in Chymico laboratorio nunquam comprobatam, nec unquam comprobandam imaginationem probabile judicat, ſubjiciam, ipſiuſque deliramenta adorem?

Quod autem ignitio, vel ignis, qua inſtrumentum tantum, ad productionem Salis Alcali fixi requiratur, inter cætera ex Tartaro quoque patet, quippe qui utrque primaria præſidia poſſidet. Poſſidet, ut notum eſt, partes oleoſo-bituminoſas, continet etiam apertum ſal acidum, & utrumque in abundantia; quod ſi autem ex hoc Sal Alkali abſque igne artificioſe deberet produci, tum nihil amplius adhibendum foret, quam volumen, vel terra quædam, in quam parum acidi & inflammabilis ſeſe innecteret, & innidularetur; proinde pro hoc ſcopo oculos Cancri, vel aliud corpus terreum, quod ad minimum cum nullo alio acido imbutum eſſet, adhibere poſſent. Solve igitur in Tartari ſolutione, tantum ante dicti terrei corporis, quantum ſolvi poteſt, evapora aquam & exſicca, tum equidem ex propria mea hypotheſi, qua dixi, quod ſal acidum & inflammabile in terra concentrata abſolvant Sal Alcali fixum, vel quod Sal Alcali fixum ex copioſiore terra & pauciore ſale acido & inflammabili fixiore conſiſtat, poſſibilitatem & mixtum quoddam, quod in pluribus circumſtantiis ut Alcali fixum ſeſe gerit, oculis ſiſtes; verum examinetur ulterius ſecundum mones à me allatas probationes veri & perfecti Salis Alcalino-fixi, tum mox hic, mox alibi patebit, nulla adhuc illi deeſſe, & quomodo totum mixtum, ſolutio tantum oculorum cancrorum in acido Tartari, adeoque ſuperfluum acidum & oleum, br viter ipſe Tartarus crudus adhuc ſimul in illo immerſus & irretitus ſit, per conſequens nullo modo verum & perfectum Sal Alcali fixum conſtituat, nulla alia ex ratione,

quam quia nullus ignis adhibitus fuit, non ac ſi ex igne plures adhuc particulæ ignis ad hoc neceſſariæ eſſent, ſiquidem, prout dixi, hic adhuc ſuperfluæ inflammabiles partes in oleo Tartari præſentes ſunt, ſed propterea quia ſuperfluum oleum & acidum exinde ſeparari debuiſſent, unde etiam in hoc experimento, formatio Salis Alcali ad oculum patet, ſimulac modo plus acidi & Alcali per adhibitum calorem ſenſim ſenſimque expulſum, & operationi per neceſſarium inſtrumentum colophon impoſitus fuit.

Induſtrius olim *Kunckelius* jam tum temporis animadvertit, quod ex Tartaro & Calce viva, ſi utraque cum aqua coquendo elixivientur, poſſibilis demonſtratio Salis-Alcalini, abſque adhibita ſicca ignitione demonſtrari poſſit; cum vero cum præcedentibus circiter conveniat, & eadem ratione quædam partes olei empyreumatici Tartari adhuc aliquatenus reſtent, ſuperfluum exiſtimo iſtud in meæ hypotheſeos probationem adducere, prout & alias non paucas adhuc cum variis acidis imprægnatas terras, vel plenarias terrarum ſolutiones, tanquam falſa Salia Alcalino fixa adducere poſſem, niſi prolixitati parcerem.

V. *De Salibus Alcalino-fixis maxime uſualibus, & quomodo paranda ſint?*

Equidem ſatis ſuperque notum eſt, quod ex omnibus vegetabilibus, vel potius eorum cineribus Sal Alcali parari poſſit, nec non quod ex permultis herbis & permultis aliis partibus à non exiguo temporis ſpatio ejuſmodi lixivioſa Salia confecta fuerint, & denique quod eodem modo omnia conficiantur, nihilo minus quædam adhuc de hac materia, tam in genere de Salibus fixis herbarum, quam etiam in ſpecie de reſiduis adhuc in Chymia uſualibus Salibus Alcalino-fixis,

ſeu

ſeu potius eorum præparatione, quantum fieri poteſt, brevibus adducam.

Modus procedendi ab aliis in 9, ab aliis vero in 6 puncta diſtribuitur; qui in novem puncta ipſum diſpertiuntur, appellant operationes vel labores, qui pro hoc ſcopo cum ſubjecto vegetabili perficiuntur, prout ex ordine ſequuntur, deſiccationem, combuſtionem, extractionem, ſeparationem, inſpiſſationem, calcinationem, ſolutionem, filtrationem & inſpiſſationem.

Qui vero 6. puncta tantum requirunt, appellant hos labores, deſiccationem, combuſtionem, extractionem, ſeparationem, inſpiſſationem & depurationem.

Ego ad quatuor eas reduco, nimirum *incinerationem*, *elixiviationem*, *inſpiſſationem & depurationem*, dum ſcilicet unus labor alterum ſemper præſupponit; quod ſi enim *de incineratione* loquor, quod nempe vegetabile primo in cineres exuri debeat, tum hoc jam præſupponit deſiccationem, vel quod antea, ſi non ex toto, ſaltem aliqua ex parte exſiccari debeat. Si de ſecundo puncto *elixiviatione* ſcilicet loquor, vel ipſæ anus norunt, quod nullum lixivium abſque aqua vel extractione fieri poſſit; norunt quoque, quod hæc *extractio*, ſi lixivium appellari debet, à cineribus ſeparanda ſit, ut proinde elixiviatio extractionem & ſeparationem utique præſupponat; & ſic etiam ſub operationibus *depurationis*, neceſſariæ ad eam calcinationes, ſolutiones, filtrationes & inſpiſſationes intelligendæ veniunt.

Totus proceſſus producendi Salia Alcalia fixa ex herbis, ſequentibus abſolvitur momentis, quæ breviter percurremus: Recipitur herba ejuſmodi, eaque leniter ſiccatur; partem aliquam ſiccatæ herbæ de alio igne incende, in ignem ſenſim ſenſimque reliquum herbarum conſtanter projice, ita ut leni tantum carbonum igne, minime vero aperta flamma, exuratur &

in

in cineres redigatur, cui rei non parum favet, ſi hic carbonum ignis circa ultimum in magis magiſque anguſtum ſemper acervum colligatur. Quod ſi tandem penitus exuſtio peracta eſt, refrigeſcat, cinis cribretur, ut reſtantes forte non plane incineratæ particulæ ſeparentur, cinis aqua frigida plenarie elixivietur, lixivium filtretur, filtratum vel in figulino, vel vitreo vaſe leniter evaporetur, denique ad ſiccitatem inſpiſſetur.

Medico uſui ſi adaptari debent, & ſi Medicus externam plane non neceſſariam,imo potius noxiam magis quam utilem, pulchritudinem & candorem reſpicere non vult, tum prima hæc inſpiſſatio ſufficere poterit; quod ſi vero depurari, imo ex parte plane cryſtalliſari debent, tum calcinantur parum, & denuo in magna ſatis portione aquæ ſolvuntur, filtrantur, rurſuſque leniter evaporantur eouſque,donec in ſuperficie parva cuticula apparere incipiat; tum enim in fundum detruncatæ cucurbitæ, vel aliud ampli orificii vitrum infundatur, & impoſita leviter charta a cinere vel aliis ſordibus præcaveatur, & in locum temperate calidum reponatur, tum ſenſim ſenſimque magna pars in pulchras & egregias cryſtallos jucundo ſæpe ſpectaculo vertetur, præcipue ſi lixivium, adhuc ante apparitionem cuticulæ, ab igne auferatur, & in locum leniſſime calidum ad cryſtalliſandum reponatur, & abſque ulla motitatione ſatis temporis ipſi concedatur. Poſtquam igitur in cryſtallos concrevit, reſtans lixivium ab iis decantetur, pars humiditatis rurſus leni igne exhaletur, rurſus in ante dictum temperatum locum reponatur, ut reſiduum, quantum fieri poteſt, cryſtalliſet, quæ tamen cryſtalli plerumque pulchritudine ad priores non accedunt, ſed multo minores, imo plane aliter formatæ eſſe ſolent. Quod tum vero ſupereſt liquidum,

decantetur

decantetur, & tandem plenarie inſpiſſetur; cryſtalli autem ſemper pauca aqua deſtillata communi celeriter abluantur, & tum ſuper pura charta bibula ab adhærente humiditate leniter ſiccentur. Si vero non cryſtallos, ſed tantum depuratum album Sal Alcali deſideres, ante dicto diuturno labore ſuperſedere, & tantum poſt primam calcinationem, ſolutionem & filtrationem, ad ſiccitatem leniter inſpiſſare, & tum in obturato firmiter vitro ab aëre bene præmunire poteris. Hæc igitur eſt generalis methodus, qua ratione ex omnibus herbis, quæ in Pharmacopoliis et in Medicina adhuc uſitata ſunt, ſalia lixivioſa herbarum, florum, ſtipitum *&c.* puriſſime & optime præparari poſſunt, ubi tria adhuc monenda erunt.

1. Simulac una tantum, vel altera levis circumſtantia in ante dicto proceſſu immutatur, ſive ſit in exurendo, in elixiviando, evaporando, calcinando, ſive quicquid ejus rei ſit, quod ſtatim et infallibiliter modo hic, modo alibi immutatum ſal acquiſiturus ſis.

2. Quod in ejuſmodi depuratis et cryſtalliſatis Salibus Lixivioſis nulla, quæ in ſubjecto antea fuit, ſpecifica virtus & proprietas demonſtrari queat.

3. Quod omnia uſitata & præcipue cryſtalliſata Salia herbarum nunquam pura Salia Alcalino-fixa ſint, vel qua talia ad alios Chymicos labores, in quibus purum Sal Alcali fixum requiritur, adhiberi debeant.

Tachenius

Tachenius et cum eo alii contendunt, herbas recentes plus ſalis largiri quam ſiccatas, *Rivinus* autem id pernegat, et ait, ſe id omni adhibita diligentia obſervaſſe, & de eadem herba probam ſumſiſſe; ſed nullum diſcrimen in iis potuiſſe reperire. Meo quidem judicio uterque certo modo verum dixit: Nam ſi ejuſmodi vegetabile tractes, quod nullum ſubtile vel volatile ſal acidum continet, tum ex ſiccato idem pondus ſalis ac ex recenti acquires: vel etiam ſi herbam recentem, aperto igne flammæ, ſiccatam contra leni tantum candefactionis igne incineres, itidem ſemper idem fere aut ſaltem parum differens pondus, quamvis non ejuſdem indolis, Salis Alcalini emerget, adeoque hac ratione *Rivini* quoque opinio veritati conſona eſt.

Sed ſi ejuſmodi vegetabile ſub manus ſit, quod vel tenerum, ſubtile, vel etiam cum aliis partibus obiter tantum commixtum ſal acidum continet, quod ſub incineratione facillime abſcedit, exhalat, evaporat & aufugit; tum utique recens, aut ſaltem non adeo plene exſiccatum multo plus Salis largietur, quam aliud, licet tamen unam vel alteram adhuc enchireſin requirat, et hac ratione *Tachenius* applauſum meretur.

Dantur vegetabilia, quæ omni licet induſtria et præcautione ſub incineratione adhibita, tamen ſubtile ſuum et ad fabricam Salis Alcalici neceſſarium ſal acidum dimittunt, ita ut ex magna ſatis quantitate perparum tamen Salis Alcalici fixi acquiratur. Quod ſi autem exhalatio ſalis acidi hoc vel alio modo impediatur, tum ad oculum plus Salis Alcalini fixi prodibit, id quod rurſus ea, quæ de generatione et formatione horum ſalium dixi, luculenter confirmat.

Hoc quo eo magis pateſcat, recipiatur tantum *Lignum Guajacum*, vel *Sanctum*, quippe quod ejuſmodi ſubjectum exiſtit, quod ſub deflagratione ſal ſuum

 acidum

acidum perquam facile dimittit, quod ſi ſatis magna ejus quantitas exuratur, incineretur, & ex cineribus omni cum præcautione Sal Alkali colligatur, perquam *exigua* ipſius *quantitas* erit ſecundum proportionem aſſumpti ligni; cujus rei rationem modo attuli, quia ſcilicet ſubtile acidum, ſub deflagratione & effumatione plurima ex parte diffugit; quod ſi autem eadem ligni quantitas in minutiſſima fruſtula concidatur, vel plane raſpetur, & hoc cum magna aquæ quantitate excoquatur, decoctum coletur, reſiduo ligno recens aqua affundatur, & excoctio eo uſque continuetur, donec aqua non amplius tingatur, decocta omnia confundantur, evaporentur, & in extractum inſpiſſentur, quod leniter exſiccetur, & tum tam hoc quam reſidua ſeorſim ſiccata raſpatura vel fruſtula leniter candefaciendo exurantur & incinerentur, tum elixivientur, & methodo conſueta Sal Alkali ex iis colligatur, mirum quanto *major* ipſius *quantitas* inde proditura ſit, quod & de non paucis aliis valet.

Præter allata Salia Alcalino-fixa herbarum, proſtat etiam Alcali quoddam lignorum minime pretioſum, & ad multas operationes non incommodum, hoc, quamvis jam plene elixiviatum, inſpiſſatum & calcinatum Sal Alcali revera exiſtat, tamen communiter tam Latina, quam Germanica, ut & quibuſdam aliis linguis, *cinis* tantum appellatur, *cineres clavellatos* indigito. Quicquid ſit, ſive olim purus non elixatus cinis ſub hoc nomine venditus, indeque denominatio retenta fuerit, ſive alia cauſa fuerit, originem hujus nominis inquirere operæ pretium eſſe vix exiſtimo. Interim cineres clavellati unicuique ſatis noti ſunt, et a quibuſdam ſimpliciter *Sal Alcali* appellantur. Præparantur communiter ex cineribus lignorum duriorum, fagi, aceris, betulæ, fraxini, quercus & ſimilium, unde & quomodo parentur, &

qua

qua ratione optimi cognoſcuntur, videre licet in *Kunckelii Arte Vitriaria*, *Valentini Muſæo Muſæorum*, & in Tractatulo, qui *Ars tinctoria experimentalis & fundamentalis* inſignitur.

Hi cineres clavellati prout emuntur & venduntur, *non* conſtituunt plane *purum* & ad omnes labores chymicos aptum *Sal Alcali*, quapropter ii antea adhuc ſemel depurandi ſunt, quod non difficulter fieri poteſt, ſiquidem nihil aliud agendum, quam ut dictis cineribus clavellatis *aqua* & quidem *frigida*, ſed ne nimia copia, affundatur, ſolvantur, ſolutio filtretur, leniter evaporetur & inſpiſſetur, tum eadem ratione & bonitate ac quodvis *puriſſimum Sal Alcali* adhiberi poterit. Id quod a decantata ſolutione cinerum clavellatorum reſtat, & in aqua frigida ſolvi negat, *non* eſt amplius *purum Sal Alcali* fixum, ſed præter partes alcalinas adhuc etiam de *Sale acido*, & quidem *vitriolico*, participat : nam ſi iſtud aqua fervide calente plene diſſolvatur, filtretur, & ſolutio, poſtquam ex parte evaporata fuit, per aliquot horas reponatur, candidas & egregias cryſtallos reperies, quæ in omnibus probis & inquiſitionibus ut verum ſal enixum ſeu medium, quod ex alcali fixo & acido Vitriolico componitur, breviter ut *Tartarus vitriolatus* ſeſe gerant ; quod autem ab hac ſecunda cinerum clavellatorum cum aqua fervida tractatione ſolvi recuſat, & in filtro remanet, ſunt inutiles plane fæces & ſordes.

Præterea extat aliud purum Sal Alcalino-fixum, quod ordinario pro optimo habetur, & hactenus tam ad Chymiam, quam ad Medicinam præ omnibus aliis adhibitum fuit ; eſt iſtud *Sal Tartari* ; qua ratione id paretur, itidem res eſt ſatis ſuperque nota, qui vero illud tenerius & penetrantius requirit, duplici modo hoc adipiſci poterit, *vel calcinando, ſolvendo, filtrando & inſpiſſando, vel etiam calcinando, per deliquium ſolvendo, filtrando*

filtrando et inſpiſſando ; hi duo purificandi modi, ſi non ſæpiuſcule reiterentur, in pleriſque conveniunt, & tum *differunt tantum in ſolvendo & deliqueſcendo:* quod ſi autem una ex parte *calcinatio*, et altera ex parte *deliqueſcentia* ſæpe ſæpiuſque inſtituatur & reiteretur, tum ingens utique & ſat *notabile diſcrimen* oſtendent.

1. Inſtituta & reiterata ſæpe *calcinatione* ſenſim ſenſimque aliquid de reſtante adhuc inflammabili & ſale acido, imo & de ſubtiliſſima terreſtri parte ipſa deſtruitur, imo totum mixtum Sal Alkali conſtituens quaſi invertitur,& in puram in aqua non amplius diſſolubilem *Terram* commutatur: quod ſi ſupra adductorum Autorum opinio vera exiſteret, & *particulæ ignis* ad productionem Salis Alkali,*tanquam materiale ingrediens*, concurrerent, hic plane non ad ejuſmodi deſtructionem, ſed potius ad augmentationem Salis Alkali fixi devenire deberet, dum hac ſæpius repetita calcinatione *recentes* ſemper *particulæ ignis* admoventur, tantum abeſt, ut eæ deficere poſſint ; nihilominus unuſquiſque veritatem dictorum experiri, deque hac repetita calcinatione experientiam conſulere poterit.

2. E contra, inſtituta & repetita *ſæpius ſolutio per deliquium* & inſpiſſatio plane contrarium demonſtrat, dum ejus vice, quod per calcinationem ſubtilius aufugit, & magis terreſtre remanet, hic potius ejuſmodi crudiores terreſtres particulæ ex Salibus Alcalibus fixis potius ſeparantur, extricantur, *teneriores* contra *& ſubtiliores* in his per deliquium ſolutis ſalibus retinentur, unde ejuſmodi ſalia, hac ſæpe ſæpiuſque repetita per deliquium ſolutione, eo tandem redigi poſſunt, ut *nec in frigore, nec in calore amplius ſiccam conſiſtentiam recuperent, ſed ſemper conſiſtentiam humidam, fluxilem,* forte ut oleum Vitrioli, *conſervent*, & in igne ejuſmodi

ejuſmodi ſal tenuiora crucibula potius ſolvat, craſſiora autem citius penetret, quam in forma ſicca appareat.

Non inuſitatum etiam Sal Alcali fixum eſt ita appellatum *Nitrum fixum*, ſeu Nitrum alcaliſatum: Quod licet cuique notum, ejuſque præparatio tanquam vilis & nauci æſtimari poſſit, meas tamen quoque circa iſtud negotium cogitationes, forte quibuſdam ſcitu adhuc neceſſarias, jam exponam.

Alkaliſatio Nitri ſequenti innititur fundamento: ſimulac *Nitrum cum quodam bituminoſo vel craſſe terreſtri inflammabili corpore miſcetur & detonatur*, ſtatim una ex parte Nitri reſolutio, & contra altera ex parte generatio, vel nova compoſitio Salis Alcali oritur, ubi bene inſimul notandum, quod non tantum Sal Alkali fixum, ſed & in eodem momento *adhuc Sal Alcali volatile, vel urinoſum* generetur, quæ ſingularis metamorphoſis attento Chymico non tantum nudam & gratam admirationem cauſatur, ſed & ſæpius revera ad manu palpabilem, ut ita dicam, cognitionem imperſcrutabilis omnipotentiæ Dei, & maxime ſubmiſſam venerationem mirabilium ſuorum operum devotam mentem conducit.

Sed, ut ad propoſitum meum revertar, quod ſi, inquam, Nitrum cum terreſtri quodam inflammabili corpore commiſcetur, exempli gratia, bitumine, pice, colophonio, fuligine, tartaro, maſtiche, ſulphure communi, carbonibus, gummi ſandarachæ & ſimilibus, tum Alkaliſatio ſtatim procedit, ſimulac cum iis detonatur, vel deflagrat; ſed cum *ſubtilioribus* mixtis *inflammabilibus*, ut ſpiritu vini rectificatiſſimo, & ipſis oleis deſtillatis, non ita procedit; niſi cum poſterioribus ſingularia artificia adhibeantur. Viliſſimum & proinde etiam uſitatiſſimum additamentum ſunt carbones pulveriſati, ut notum eſt; ne autem hunc tibi conceptum in animo formes, ac ſi Sal Alkali ex adhibitis carbonibus

bus ortum duceret, ſiquidem tota carbonum libra tantum aliquot drachmas cinerum, hi cineres vero tantum aliquot grana Salis Alcali fixi largiuntur, id totum fere a Nitro ipſo dependet, unde quoque pro ulteriori adhuc penſitatione adducam ſequentia momenta. Libra una optime depurati Nitri cryſtallini continet præter propter partem dimidiam aquæ, unam quartam ſalis acidi, & unam quartam additamenti Alcalini, quod ad corporificationem acidi nitroſi, & ad figurationem formæ cryſtallinæ in conficiendo Nitro additur, unde quoque totum Nitrum ſal medium exiſtit; quod ſi autem huic libræ Nitri tres vel quatuor carbonum uncias admiſceas, quæ *per ſe* circiter 3. *vel* 4. *grana Salis Alkali* fixi ſuppeditant, & cum hac carbonum quantitate ante dictam Nitri libram alcaliſes, accipies 8. vel 10. imo, ſi recte operatus fueris, fere 12. uncias purificati & boni Salis Alcalini. Jam ergo oritur quæſtio: *unde tantum pondus?* ſi quidem vix 4. unciæ additamenti alcalini in tota Nitri libra præſto ſunt. Quiſque rem hanc ulterius conſideret, & ea, quæ de origine Salis Alcali fuſe ſatis dixi, in conſilium trahat; forte tum quæſtionem hanc ſibi ipſemet facile diſſolvere poterit.

Dixi equidem in genere, Nitrum cum omnibus craſſe terreſtribus inflammabilibus ſubjectis alcaliſari poſſe; ſed ne cogites proinde velim, ac ſi etiam in genere unum, & quoad omnia ſemper idem, Sal Alkali fixum inde proditurum ſit. Minime; ſed prout inter inflammabilia additamenta ipſa, modo hoc, modo illud diſcrimen reperitur, ita ſemper utique aliquo modo diverſum, modo magis vel minus ſubtile, craſſius, modo ſumme cauſticum, vel etiam obtuſius, ſemper tamen Nitrum fixum, quamvis non ubique & omni ex parte plane æquale, ſed ut dixi, modo hic, modo alibi differens

differens Alcali, quod vel a proportione, vel, & quidem ut plurimum, a differente indole & natura additamenti, ut & ſingulari ratione ab iſto magis magiſque fixo, vel in aliis fixis materiis concentrato, inflammabili dependet, ex quo *cauſticitas* quoque primario *ortum* ſuum *deducit*, *e. g.* ſi nitro ejuſmodi ſubjectum admiſceo, in quo inflammabile equidem copioſe, ſed *tantum ſuperficie tenus* præſto, imo *cum multa aqua* adhuc extenſum, & proinde *magis ad volatilitatem diſpoſitum* eſt, ut *in reſinis*, pice, colophonio & ſimilibus, tum accipio quidem *nitrum fixum*, ſeu alkaliſatum, ſed longe *non adeo cauſticum*, quam ſi ejuſmodi ſubjectum ipſe addo, in quo *phlogiſton magis fixum & terreſtre* factum eſt, quod iterum ex gr. *per additamentum Reguli Antimonii Martialis* facile demonſtrari poteſt ; quippe in quo ſolummodo concentratum principium *inflammabile terreæ indolis* ex Marte *cauſticitatis vera cauſa* exiſtit, qua occaſione non diffiteor, memet ipſum, in quantum adhuc *originem cauſticitatis* conſideravi & obſervavi, huc uſque *nullum Sal Alcali fixum abſque additione ſubjecti mineralis cauſticum reddere noſſe* & poſſe, ut propterea hæc materia ulteriore adhuc diſquiſitione indigeat ; imprimis cum & alia occaſione oſtenderim, qua ratione ex eodem plane fundamento *Sal Alcali volatile cauſticum* produci queat.

Ordinarium *Nitrum cauſticum* fixum ex partibus anaticis Reguli Antimonii Martialis & nitri cryſtalliſati pulveriſatis ante & mixtis cæmentando paratur, prout notum eſt.

Quin & Regulus Antimonii, calx viva, ut & plura alia mineralia tartaro crudo ejuſque ſali, imo etiam ipſis depuratis cineribus clavellatis, methodo ſatis nota *enormem cauſticitatem* inferunt, ita ut ordinarium cum calce viva & depuratis cineribus clavellatis, vel ſale

tartari paratum, & ordinario quoque appellatum *Sal alcali cauſticum* omnia corpora tenacia animalium, ut pennas, crines, lanam, oſſa, cornua, ungulos, *&c.* in *mucum*, & pinguedines parvo temporis ſpatio in *ſaponem*, ſulphur autem in *rubrum liquorem* diſſolvat. Quod ſi hoc Sal in forma liquida ſolutum exiſtat, tum appellatur *lixivium ſaponariorum*; ſi adhuc ſemel in crucibulo fundatur, & tum in exiguas oblongas portiones, præter propter ut partes fiſtulæ tabaci ſimiles, effundatur, tum *lapis infernalis alcalicus*, *cauterium potentiale*, imo & quibus *Sal Chirurgorum* appellatur.

Tandem præter *duas* has a me allegatas magiſque conſuetas *nitrum* alcaliſandi *methodos*, *adhuc tertia* huc illuc uſitata eſt, nimirum, *ſi nitro*, carbonum vel reguli loco, *tartarus pulveriſatus addatur*. Quanquam hoc præparatum, ex uſitata conſuetudine, *nunquam nitrum fixum*, ſed poſtquam elixiviatum & inſpiſſatum fuit, potius *ſal tartari extemporaneum*, & ſi non elixiviatum vel depuratum fuerit apud aurifabros, docimaſtas, metallurgos, monetarum tractatores, zonarios, alioſque circa metalla verſantes artifices, *fluxus niger* appelletur: Verum & hoc nitrum fixum non ita promiſcue pro quovis alio ſumendum erit, ſi quidem itidem *pro diverſa* dictorum duorum ingredientium *proportione*, *etiam diverſa ſalia* emergunt.

Quod ſi igitur *fluxum* hunc *nigrum* præparare volo, recipiuntur 1. vel *partes æquales* utriuſque, vel etiam 2. *nitri pars una & tartari partes duæ vel tres:* ante dicti mechanici artifices ſolent utrumque ſeorſim pulveriſare, pulveres utroſque miſcere, tum in purum ferreum mortarium injicere & pruna candente incendere, & plerumque hoc ita crude adhibent, abſque ulla elixatione, filtratione & inſpiſſatione, ſeu depuratione. 3. Quod ſi vero prima ſtatim detonatione album plane ſal deſidero, tum *ad tres*

vel duas nitri partes tantum unica tartari recipitur.

Circa has tres *diverſas proportiones*, ut ante jam notavi, etiam ſequentes *diverſæ circumſtantiæ* occurrunt.

1. *Si* 2 *partes nitri ad unam tartari partem* aſſumantur, tum *non omne nitrum* plane *alcaliſatum* exiſtit, ſed ex parte adhuc nitrum crudum ei inexiſtit.

2. *Si* 2 *vel* 3 *partes tartari cum* 1 *parte nitri* commiſceantur, tum omne nitrum equidem reſolutum & alcaliſatum eſt, ſed e contra *non omnis oleoſa tartari ſubſtantia conſumpta & exuſta* eſt, ſed magna pars adhuc reſtat, unde quoque idcirco *hæc proportio* tantum & unice ad *liquefactiones* & *reductiones metallorum* præ aliis proportionibus longe commodior, aptior & *utilior* deprehenditur, interim & hoc (ſi volupe fuerit) inſtituta de novo calcinatione, itidem a ſuperfluis oleoſis partibus liberari, & ſic in *perfectum Sal alcali redigi* poteſt, quod vero tum ſal tartari extemporaneum, vel ex tempore paratum, vocari non poteſt.

3. Proportio media, ubi *partes anaticæ* aſſumuntur, optima quidem videtur, interim negari non poteſt & eam *adhuc* quandam *nitri crudi partem* ſecum retinere.

Sub hac modo adducta, & tanto magis *ex* 2 *partibus nitri* compoſita proportione, durante deflagratione, *realis ſeparatio principiorum vel partium conſtituentium tartari oboritur*, ubi 4 *notabiles circumſtantiæ & momenta* occurrunt.

1. Maxima pars oleoſitatis tartari non modo reſolvitur, ſed & ita conſumitur, ut vice ejus quod alias in deſtillatione tartari notabilis *copia olei*

in forma fluida ſeparatur & apparet, *hic* ſub detonatione cum nitro *nullum* aliud *ipſius veſtigium*, quam paucum ſiccæ fuliginis ob oculos veniat.

2. Altera notabilis circumſtantia ſub hac ſalis tartari extemporanei formatione hæc eſt, quod, cum alias durante deſtillatione vel exuſtione tartari, ſeparatio olei, ſpiritus & phlegmatis una ex parte, & nova formatio ſalis fixi alcalini altera ex parte, per conſequens *omnia tarde* eveniant, & aliquod temporis ſpatium requirat, *hic omnia ſimul & ſemel unico momento* & unica detonatione procedunt.

3. Notum eſt quod tartarus & nitrum (quodvis ſeorſim) *ſi deſtillentur, ſpiritum acidum* ſuppeditent, *hic autem*, ubi hæc duo ſalina mixta conjunctim deflagrant, *ne hilum* quidem *acidi* emergit, *ſed* rurſus plane aliud, imo *contrarium*, & de novo formatum, *ſcilicet urinoſum* ſenſibus noſtris ſeſe ſiſtit.

4. Quarta non minus notabilis circumſtantia hæc eſt, quod, cum in communi exuſtione tartari per ſe uſque additamento, ſemper *non exigua portio terræ indiſſolubilis* poſt perpetratam Salis Alcalici elixiviationem reſtet, hic in ſalis tartari extemporanei præparatione *fere nihil indiſſolubilis terræ* reperiatur, ſed omne iſtud *in purum ſal*, & quidem adhuc, ut ante jam dixi, *in momento & incomprehenſibili celeritate* convertatur.

Partem reliquam hujus Diſſertationis proxima occaſione communicabimus.

II. *Obſer-*

II. *Obſervations of the Eclipſe of the Moon*, Octob. 10*th*. 1725. *made at* Briſtol, *by* John Burroughs *Eſq*; *communicated in a Letter to Mr.* Cheſelden, Surgeon *to St.* Thomas's *Hoſpital*, *F. R. S.*

THE cloudy Weather here prevented us from ſeeing the Beginning of the Eclipſe, or of total Darkneſs; but I obſerved, pretty exactly, the firſt Appearance of Light, after the total Darkneſs, and the End of the Eclipſe; and their reſpective Times are as follows, *viz.*

	h	′	″	
Beginning of Light	7	31	20	} apparent Time.
End of the Eclipſe	8	29	30	

Some ſmall Time before the renewal of true Light, there appeared a remarkable Brightneſs upon the Eaſtern Limb of the Moon, which I am not certain how to account for; at firſt I reaſoned with my ſelf in this Manner; That all the Light which the Moon has, during her total Immerſion in the Shadow, is by Rays from the Sun, refracted through the Earth's Atmoſphere, and conſequently thoſe Rays muſt be in greater Plenty, near the Edge of the Shadow, than near the Axis. But this does not fully anſwer the Phænomenon, becauſe the Light I ſpeak of, was not only upon the Moon itſelf, (on whoſe Eaſtern Limb there was a manifeſt increaſe of Light, as ſhe approached the Edge of the Shadow) but it was alſo diffuſed about the Edge of the Moon, to a ſenſible

Distance, which I would certainly have measured, if I had had proper Instruments. And if others, who are more skilled in these Affairs, have made the like Observation, I shall no longer doubt of the Moon's having an Atmosphere.

Bristol, Feb. 19. 1725.

III. *Sceleton duorum Humanorum petrefactorum pars. Ex Epistola* Joh. Jac. Scheuczer, *M. D. R. S. S. ad Dom.* Hans Sloane, *Baronettum, S. R. V. Pr.*

NOSTI, Vir Expertissime, ex hominum diluvio submersonum genere paucas superstites esse reliquias. Neque ego hactenus in numerosa satis collectione plures habui quam binas dorsi vertebras, atro-nitentis splendoris, petrefactas. Nunc autem, ἀγαθῇ τύχῃ Museolo meo illatum, lapidi fissili *Oeningensi* immersum λείψανον, omni attentione dignissimum, in quo distincte cernere licet, non vagæ imaginationis simulacra, sed capitis humani à quovis alio animantium genere distinctivi partes benè multas, reapse residuas, cranii ambitum, os frontis, ossa sincipitis, occipitis, orbitam oculi, baseos cerebri & medullæ oblongatæ λείψανα, prominentiam interiorem ossis occipitalis, quæ cerebelli lobos separat, colli vertebras numero 7, partim denudatas, partim lapideo cortice tectas, & est hæc veluti orthographica sectio posterioris capitis partis.

Sed

Sed inde ex quo Monumenti hujus fui potitus, ſingulari Divinâ Providentiâ novus ex dicta lapicidina advolavit hoſpes, carior tantò, quia eſt ex rariſſimis, charior, quòd nec veſte opus habeat, nec alimento, omnia ſecum portans, priorem vincens & magnitudine, & ætate, & curioſitate. Adſunt nempe in dicto fiſſili lapide demerſa, ex hominis adulti ſceleto, ejuſve ſtructura anteriore, peripheria oſſis frontalis, os jugale, orbitæ oculorum, cranii tabulæ cum diplöe, veſtigia foraminis infraorbitalis deſtinati pro tranſitu nervorum quinti paris, reliquiæ vel ipſius cerebri, vel duræ matris, oſſa cribroſa & ſpongioſa, os vomeris naſum diſterminans, oſſis quarti maxillaris portio, quæ genas conſtituit, naſi reliquiæ, maſſeteris portio, ſectio orthographica tranſiens per apophyſin condyloidem maxillæ inferioris ad angulum uſque hujuſdem maxillæ, vertebræ in continua ſerie numero 16, pleræque cum proceſſibus tranſverſis, claviculæ dextræ extrema portio, quæ ſcapulæ nectitur, ſiniſtræ media portio lapide tecta. Ex qua ſceleti proportione judico, integram hominis ſtaturam fuiſſe eandem, quæ incirca mea eſt, 58½. pollicum Pariſienſium.

Tiguri, 25 *Decemb.* 1725.

IV. *Obſer-*

IV. *A Contrivance to avoid the Irregularities in a Clock's Motion, occaſion'd by the Action of Heat and Cold upon the Rod of the* Pendulum. *By Mr.* George Graham, *Watch-Maker, F. R. S.*

WHereas ſeveral, who have been curious in meaſuring of Time, have taken Notice, that the Vibrations of a Pendulum are ſlower in Summer than in Winter; and have very juſtly ſuppoſed this Alteration has proceeded from a Change of Length in the Pendulum itſelf, by the Influences of Heat and Cold upon it, in the different Seaſons of the Year; with a View therefore of correcting, in ſome degree, this Defect of the Pendulum, I made ſeveral Trials, about the Year 1715. to diſcover whether there was any conſiderable Difference of Expanſion between Braſs, Steel, Iron, Copper, Silver, *&c.* when expoſed to the ſame Degrees of Heat, as nearly as I could determine; conceiving it would not be very difficult, by making uſe of two Sorts of Metals, differing conſiderably in their Degrees of Expanſion and Contraction, to remedy, in great meaſure, the Irregularities to which common Pendulums are ſubject. But altho' it is eaſily diſcoverable, that all theſe Metals ſuffer a ſenſible Alteration of their Dimenſions by Heat and Cold; yet I found their Differences, in Quantity from one another, were ſo ſmall, as gave me no Hopes of ſucceeding this Way, and made me leave off proſecuting this Affair any farther at that Time. In the Beginning of *December*, 1721. having Occaſion for an exact Level, beſides other Materials I made Trial of, Quickſilver was one; which, although I found it was by no Means proper for a Level, yet the extraordinary Degree

gree of Expanſion, that I obſerved in it, when placed near the Fire, beyond what I had conceived to be in ſo denſe a Fluid, immediately ſuggeſted to me the Uſe that might be made of it, by applying it to a Pendulum. In a few Days after, I made the Experiment, but with much too long a Column of Quickſilver, the Clock going ſlower with an increaſe of Cold, contrary to the common Pendulum; however, it was a greater Confirmation of the Advantage to be expected from it, ſince it was eaſy to ſhorten the Column in any Degree required. The only Doubt I entertained was, leſt there ſhould not be a proportional Expanſion and Contraction between the Quickſilver, and the Rod of the Pendulum, through the various Degrees of Heat and Cold, from the one Extreme to the other. To make this Experiment the more convincing, I placed the Clock in a Part of the Houſe, the moſt expoſed of any to the Changes of Heat and Cold, the Room having no Fire in it in the Winter, and expoſed to a South Sun, with Leads above it, which, in the Summer, made it extremely hot. I hung a Thermometer by it, and had likewiſe another Clock at no greater Diſtance from it, than was neceſſary to keep the Caſes from touching one another. This Clock had been made ſome Years before, with extraordinary Care, having a Pendulum about 60 Pounds in Weight, and not vibrating above one Degree and half from the Perpendicular; and which, in a more temperate Situation, had not alter'd above 12 or 14″ in 24 Hours, between Winter and Summer; but in this Place it altered 30″ a Day, between the hotteſt and coldeſt Weather, in the Year 1722, a Year no way remarkable for either Extremes. But this great Alteration was owing to the Situation I mentioned above, and which I made Choice of for the ſake of making the Experiment the more ſenſible.

The two Clocks being firmly skrewed to a Party-Wall, I began to make the firſt Trial of this Kind of Pendulum, *December* 18. 1721. and, by *January* the third, perceiving the Pillar of Quickſilver conſiderably too long, I procured a ſhorter Glaſs, which I got ready by the eighth, and made uſe of, until the Beginning of *June* following: By which Time I was well ſatisfied of the Advantage of the Contrivance, notwithſtanding both theſe Pendulums were but rudely executed, and thi laſt had the Pillar of Quickſilver too ſhort, but much nearer the true Length than the firſt. This encouraged me to provide another Glaſs, a little longer than the laſt, and to beſtow more Care upon all the Parts of the Pendulum that required Exactneſs. This being finiſhed, by the 9th of *June*, I began then to obſerve the Motion of the Clock, by the Tranſits of the fixed Stars, as often as the Weather permitted, making uſe of a Teleſcope which moved in the Plane of the Meridian; with this Inſtrument I could be ſure of not erring above two Seconds in Time. The Clock was kept conſtantly going, without having either the Hands or Pendulum alter'd, from the 9th of *June*, 1722. to the 14th of *October*, 1725. being three Years and four Months.

For the firſt Year, I wrote down every Day, the Difference between the two Clocks, with the Heighth of the Thermometer, not omitting the Tranſits of the Stars, as often as it was clear. The Reſult of all the Obſervations was this, That the Irregularity of the Clock, with the Quickſilver Pendulum, compared with the Tranſits of the Stars, exceeded not, when greateſt, a ſixth Part of that of the other Clock with the common Pendulum; but for the greateſt Part of the Year, not above an eighth or ninth Part; and even this Quantity would have been leſſened, had the Pillar of

Mercury been a little ſhorter; for it differed a little the contrary Way from the other Clock, going faſter with Heat, and ſlower with Cold; but I made no Alteration in the Length, to avoid an Interruption of the Obſervations. To confirm this Experiment the more, about the Beginning of *July*, 1723, I took off the heavy Pendulum from the other Clock, and made another with Quickſilver, but with this Difference, that inſtead of a Glaſs Tube, I made uſe of Braſs, and varniſhed the inſide, to ſecure it from being injured by the Mercury. This Pendulum I have made uſe of ever ſince, and find it about the ſame Degree of Exactneſs as the other. The Reaſon, why this kind of Pendulum is more exact than the common Sort, will be evident to any one, who conſiders, that as Heat lengthens the Rod of the Pendulum, at the ſame Time it increaſes the Length of the Pillar of Quickſilver, and its Center of Gravity is moved upwards: And when, by Cold, the Rod of the Pendulum is ſhortened, the Pillar of Quickſilver is likewiſe ſhortened, and its Center of Gravity carried downwards; by this Means, if the Column of Quickſilver be of a proper Length, the Diſtance, between the Point of Suſpenſion and the Center of Oſcillation of the Pendulum, will be always nearly the ſame, upon which the exact Motion of a Clock principally depends. Were the Pendulum of a Clock to remain invariably of the ſame Length, yet ſome little Inequalities would appear in its Motion, from the Difference of Friction ariſing from the Imperfections of the Materials, as well as different Degrees of Foulneſs; upon which Account, the Force communicated to the Pendulum, would not be conſtantly equal, which would cauſe ſome ſmall Alteration. But when the Pendulum is very heavy, and vibrates in a ſmall Arch, and the Workmanſhip of all the Parts is well per-

formed, there will be very little Inequality in the Motion, beſides what proceeds from Heat and Cold.

In making uſe of Quickſilver for a Pendulum, by varying the Diameter of the Veſſel that contains it, or the Thickneſs of the Rod of the Pendulum, whether it be of Braſs or Steel, they may be reduced nearly to an Equality as to the receiving, or retaining the Impreſſions of Heat or Cold, upon which the greater Regularity of the Motion depends; and particular Care ought to be uſed to free the Mercury from all Blebs of Air, otherwiſe their great and ſudden Expanſion, or Contraction, may cauſe a conſiderable Diſorder; but the Air may as eaſily be excluded in this Way, as in a Barometer, and the great ſpecifick Gravity of Quickſilver, renders it a proper Material for the Weight of a Pendulum.

F I N I S.

LONDON, Printed for W. and J. Innys, Printers to the *Royal Society*, at the Weſt End of *St. Paul's Church-Yard.* 1726.

N°.393.

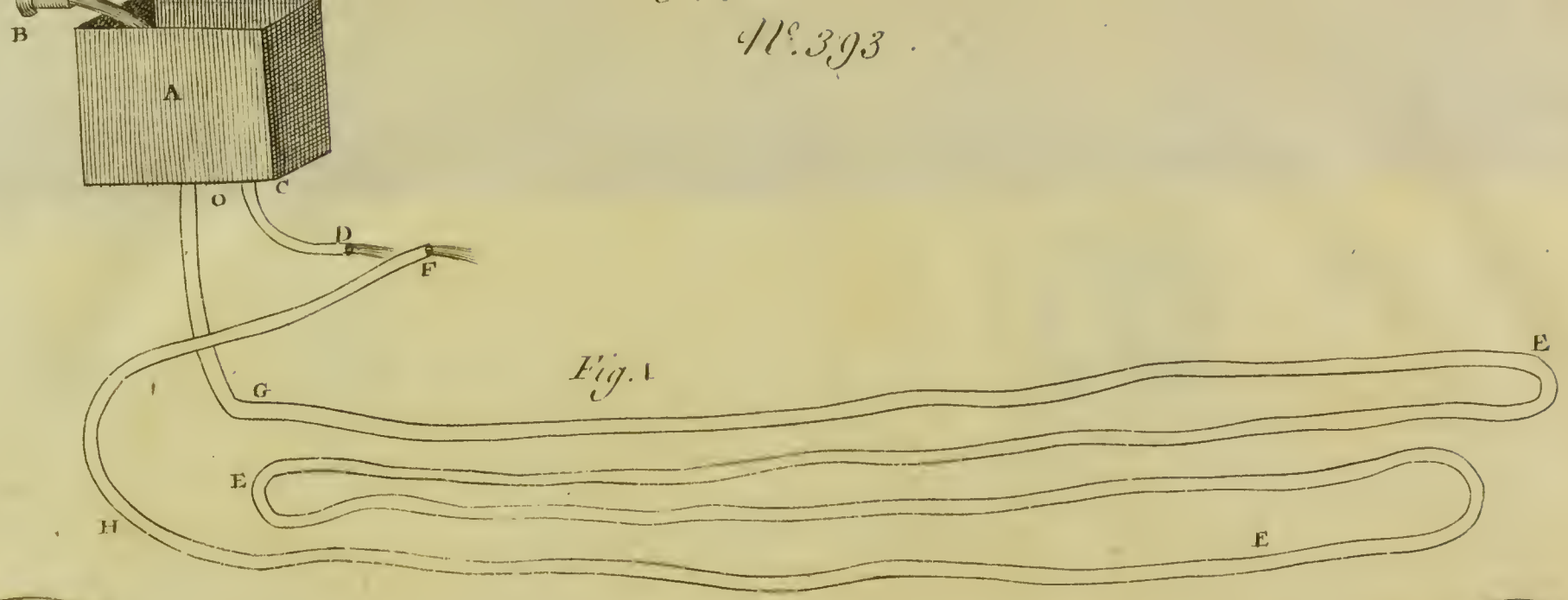
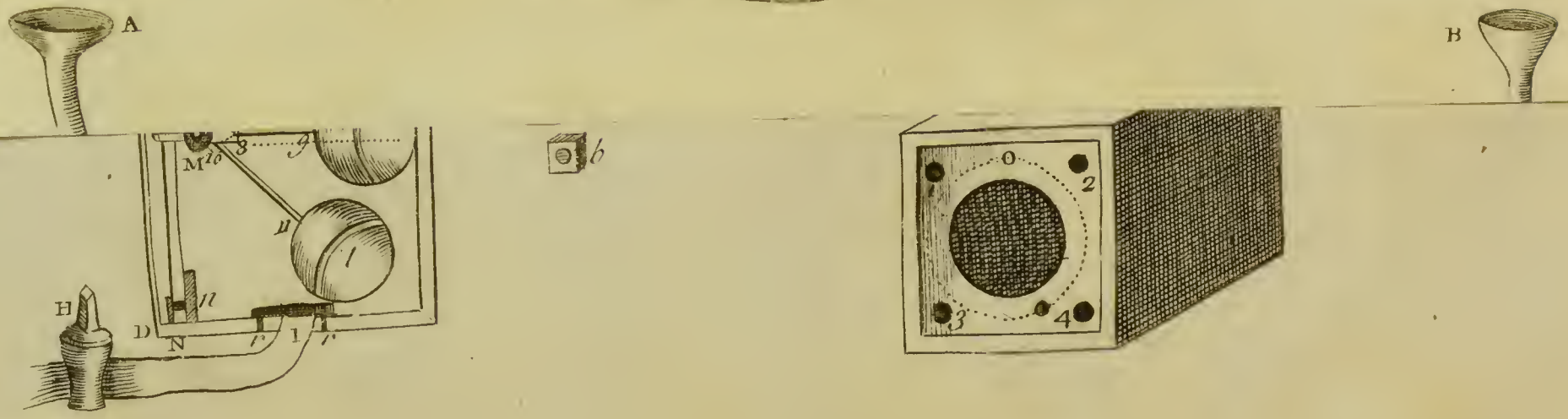


Fig. 1



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S. Parker Sculp!

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PHILOSOPHICAL TRANSACTIONS,

For the Months of *March* and *April*, 1726.

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I. De Salibus Alcalino-fixis, *Auctore* C. Neuman *Chym. Prof. Reg.* Berolin. *R. S. S.* **Pars reliqua.*

VI. *An Salia Alcalino-fixa inter ſe differant, & qua in re?*

EQuidem de hoc momento jam hinc inde quædam inſerui; nihilominus neceſſarium eſſe exiſtimo, diverſa quædam momenta, præter ea quæ curſim adduxi, hac de re adhuc in medium proferre.

De Salibus lixivioſis plantarum primum *in genere notandum* venit, Quod in quantum forſan una vel altera differentia interea ſeſe exſerit, iſta *plane non à ſpecifica indole & ſingularibus viribus*, quas una vel altera planta *ante combuſtionem & incinerationem poſſedit*, ortum trahat, ſed differentia iſta primario dependeat *à duabus aliis circumſtantiis*; (prout hoc experientiſſimus & inſignis Chymicus D. D. *Stahl* jam animadvertit) nimirum 1. *à diverſa ſtructura* vel teneriorum vel craſſiorum partium plantæ; & 2. *ab operatione*, vel mutatis in ea enchireſibus & parvis manipulationibus.

1. *Ratione ſtructuræ* acquiritur e. g. longe aliud Sal Alkali ex ſubtilibus & teneris foliis, quam ex craſſioribus caulibus ejuſdem herbæ; aliud e petalis florum, vel totis floribus, quam e lignis; aliud ex ſeminibus, quam ex radicibus; aliud ex ſucco expreſſo, quam ex extracto, quod ex ſiccata herba cum multa aqua & forti coctione paratum erat; aliud ex teneris recentibus herbis, quam ex valde exſiccatis; & ſic porro.

* V. *Phil. Tranſ.* N°. 392.

2. *Ratione operationis*, acquiritur longe aliud Sal Alkali è leni tantum fumante excandeſcentia & incineratione, quam è forti flammante combuſtione; aliud ab elixiviatione cum aqua frigida, quam cum aqua calida, imo cum reali excoctione ebullitoria; aliud ſi parum aquæ aſſumas, quam ſi multum aquæ adhibeas; aliud ſi parum & ſemel tantum calcines, quam ſi fortiter & ſæpius calcinatio reiteretur; aliud ſi Sal inſpiſſatum cum multa aqua iterum ſolvas, quam ſi per ſe in deliquium fluere permittas; idq; rurſus ſecundum plures etiam alias circumſtantias.

Sed, *niſi* Salia lixivioſa de *induſtria, forte per repetitas calcinationes, vel deliqueſcentias*, ad nimiam & maxime notabilem differentiam redigantur, in communibus ordinario uſitatis laboribus & præparationibus *horum ſalium* reperibilis *differentia parvæ vel nullius eſt conſiderationis*, excepto *ſi forte minerale* quippiam, *vel de induſtria, vel incuria, vel inſcitia adhibitum fuit.*

Quod ſi ergo apud ordinaria pure præparata ſalia lixivioſa herbarum, diverſitas quædam tamen reperiretur, in hoc tantummodo conſiſteret, quod unum magis pure alcalinum quam aliud, unum ſubtiliùs, aliud craſſius, unum magis terreſtre quam aliud, unum paulo magis cauſticum quam aliud, unum cum pluribus ab oleoſo ingrediente oriundis partibus, vel etiam copioſiore ſpiritu acido imbutum, indeque magis cryſtallinum ſit, quam alia ſalia: de cetero *ſingula ſunt ſalia lixivioſa, ſingula ſalia fixa & alcalina, ſed ſingula non ſunt vere pura, cum puriſſima ex iis adhuc ſint impura, & ad alias chymicas applicationes adhuc inepta ſalia alcalina*, dum pleraque apertum quippiam & ſuperfluum acidum, quædam etiam ſuperfluam terram aliaſque accidentales peregrinas immixtiones, ſi non voluntarias ineptas additiones, tanquam putatitia artificia pro ac-

quirendis ſpecioſis cryſtallis, ſecum foveat: Ita ut, ſi *ordinaria in Pharmacopoliis parata vegetabilium cryſtallina lixivioſa Salia*, animo revolvo, ſæpe non ſatis mirari poſſim, quare iſtiuſmodi ſalia in hodierna praxi medica adhuc toto die adhibeantur, cum tamen medico ignotum ſit, quale ſal ægrotis commendet, aut præſcribat, *quia ejuſmodi cryſtalliſata ſalia nec pura alcalina, nec perfecte ſaturata ſalia neutra exiſtunt, & per conſequens accurate novit nemo, quantum alcali, & quantum acidi una drachma vel uncia talis pulchre cryſtallini ſalis contineat*, item, *an præſens ibi & ad cryſtalliſationem diſponens acidum, vegetabile, vel minerale acidum ſit.*

Quod ſi egomet in praxi medica *Sale Alcalino fixo* opus haberem, tum purum *ſal tartari* vel etiam depuratos *cineres clavellatos* reciperem; quod *ſi ſal acidum* ex uſu foret, tum ex apertis *puris acidis* commodiſſimum ſeligerem, & *ſi ſal medium* adhibendum eſſet, itidem ejuſmodi *ex uſitatis plene ſaturatis ſalibus mediis*, quæ me certiorem reddunt, & quod ad præſentem ægritudinem pro commodiſſimo reputarem, in uſum vocarem; tum enim certo ſcirem, quid ex pharmacopolio daretur, & quid ægroti ſumerent, reliqua autem *incerta* & imperfecte ſaturata *ſalia, quæ nec pura ſalia acida, nec alcalina, nec media ſeu neutra ſunt, ſecure negligerem* & ſuo loco relinquerem.

Iſtam adhuc admonitionem & conſilium dare volo, quod ſi forte adhuc unum vel alterum ſingularem effectum ab hoc vel illo ſale vegetabili lixivioſo expectare velis, & quod ſi poſſibile eſt, ut quoddam Sal Alcalino-fixum adhuc ſingulare quippiam in re medica præ alio poſſidere queat, ut ejuſmodi herbam ad minimum quam *leniſſime excandeſcere* ſinas, *non violenter incineres, multo minus fortiter exuras*, omnium minime vero *nec cineres nec ſal calcines*, tum forte

ſpecifica quæ expectatur virtus, *in paucis* quibuſdam reſtantibus revera *oleoſis partibus* (quippe in quibus tantummodo ſitam eam eſſe oportet) aliquo modo conſervaretur; cum contra certior ſim, quod *ſi* abſque conſideratione & cautione *igne flammæ exuratur, calcinetur & depuretur*, quod inquam revera *nihil ſpecifici* nec ſingularis amplius *reperiri aut demonſtrari* queat.

Quanquam igitur curioſitatis gratia, *ex una eademque planta, abſque ullo peregrino adâitamento*, unice *mediante igne & aqua*, ut non dicam 40 vel 50, dicam tantummodo permulta genera talium alcalinorum fixorum, quorum aliud ab alio ſemper aliqua in parte, licet parum tamen aliqua in re, modo externo aſpectu, modo etiam interna leviore circumſtantia differre debet, præparare & producere norim; tamen altera quoque ex parte non ignotum mihi eſt, quod non tantum hæc multiplicia ex una eademque planta artificioſe producta, ſed & *omnia lixivioſa herbarum ſalia*, imo quod plus eſt, *omnia ſalia alcalino-fixa in orbe reperibilia ad eundem aſpectum, virtutem & efficaciam reduci poſſint:* ita ut hoc reſpectu & intellectu non niſi unicum & unius generis ſal Alcali fixum ex omnibus vegetabilibus in orbe ſtatuam, dum vel hoc unicum in varias formas & effectus, vel etiam omnia alia ad eundem aſpectum & effectum reducere poſſum, adeo ut *ſi ſalia lixivioſa ex centum vel pluribus herbis parata* ante oculos haberem, *ullum ſal, multo minus ullum ſubjectum* ex quo ejuſmodi ſal Alkali productum fuerit, *divinare poſſit nemo.* Quin nemo potis eſt tantummodo in genere cognoſcere, num ex eſculento aut innocuo, vel ex ſumme venenoſo & maxime nocivo vegetabili confectum ſit; an ſubjectum ſuaveolens, vel graveolens, plane abſque ullo odore vel fœtore fuerit; an ſapidum vel inſipidum;

purgans vel adſtringens; antiſcorbuticum, epilepticum, vel antifebrile, emeticum, vel diureticum, narcoticum, vel ſternutatorium cauſticum, vel balſamicum; an ligna, vel radices, cortex, vel medulla, flores, vel herbæ ſemina, vel ſucci, vel quicquid fuerint, ex quibus ejuſmodi præſens ſal alcalinum paratum ſit.

Exiſtimo hæc ſufficere poſſe pro iis qui adhuc conſtanter opinantur, *Salia Alcalina fixa ſpecificam* herbarum aliorumque vegetabilium, ex quibus producuntur, *virtutem ſecum retinere*, ita ut ſal caryophyllorum & cinnamomi ſtomachicum, ſal hyoſciami & papaveris narcoticum, ſal radicum jalappæ purgans, ſal radicum tormentillæ, vel corticum chinæ chinæ adſtringens vel antifebrile, ſal ipecacuanhæ & gratiolæ emeticum, ſal eſulæ cauſticum & ſal cicutæ venenoſum & lethiferum eſſet, convincendis, quin & univerſos reſurrectionis fratres ita confundendo, ut reſuſcitationem & revivificationem vegetabilium non ita facile concipere debeant, dum demonſtrari ipſis poteſt, omnia ejuſmodi ſalia lixivioſa in toto Regno Vegetabili ad eandem figuram & effectum, imo (ut ante dixi) ex eadem herba ad tam multiplicia ſalia reduci poſſe: unde aperte hic profiteor, *nemini hominum poſſibile eſſe, ex cineribus, vel lixivio ne quidem ſolam externam figuram iſtius vegetabilis, ex quo parata ſunt, rurſus producere, vel in ſale ipſo ex ejuſmodi puris ſalibus repræſentare*; de induſtria dico *ex ejuſmodi puris ſalibus*; ſiquidem ipſe non una vice vidi, ejuſmodi figuras herbarum *ex teneris æneis, & ſubtilibus linteis filis* præter propter *artificioſe concinnatis*, & in lixiviis concentratis impoſitas vel ſuſpenſas fuiſſe, ubi utique omnia ad ejuſmodi fila circumcirca cryſtalliſata fuere, quæ deceptor ignaris *tanquam veram reſuſcitationis plantarum repræſentationem* commonſtravit: verbo, tota quæ prætenditur *humana*

arte

arte reſuſcitatio, in veritate non fundata, ſed tantum chimerica imaginatio eſt, & non niſi in libris viſibilis & reperibilis, ita ut de hac materia jure dici poſſit:

Dico ego, tu dicis, ſed denique dixit & ille,
Dictaque poſt toties nil niſi dicta vides.

Reperitur etiam *inter puriora & ad chymicos labores aptiora cognita fixa alcalica ſalia* ipſa, in hac vel illa parte *quædam differentia, quæ vero* itidem ab exercitato chymico *omnia removeri*, ea penitus *æqualia & ad eandem figuram & effectum reduci poſſunt.*

D. D. *Hoffmannus* Profeſſor *Halenſis*, amicus meus æſtimatiſſimus in Libro 2. obſervationum Phyſ. Chym. ſelectiorum ſub N°. 29. totum caput hac de re conſignavit, *nihil tamen quam differentias ipſas obſervavit & protulit*, quæ præter propter & ſummatim in his conſiſtunt.

1. Si oleum vitrioli nitro fixo affunditur, tum ſub efferveſcentia verus ſpiritus nitri, vel aqua fortis exhalat.

2. Hoc vero nunquam fit, ſi oleum vitrioli ſali tartari, vel cineribus clavellatis affundatur.

3. Quin & in his utriſque poſterioribus rurſus quædam obſervatur differentia, dum a ſale tartari (ex affuſione olei vitrioli) ſuperficies nigricantem cuticulam acquirit, liquor ipſe nigricans evadit, & plane alius fœtor, quam ſpiritus nitroſi, à nitro fixo deprehenditur.

4. Omnia autem hæc a cineribus clavellatis non obſervantur, dum ab iis nec ſpiritus nitri, nec cuticula, nec nigricans color ſeu ſolutio, ſed iterum ſingularis vapor apparet.

5. Fumi

5. Fumi hi nitroſi etiam manifeſti fiunt, ſi oleum vitrioli ſali tartari extemporaneo, quod ex 2 partibus nitri & una parte tartari paratur, affunditur.

6. Quod vero iterum non licet videre in ejuſmodi ſale tartari extemporaneo, quod cum pauca additione nitri elaboratum fuit.

7. Ex ſale tartari & arena vitrum clarum & pellucidum parari non poteſt.

8. Bene autem ex ſale tartari extemporaneo, ut & ex cineribus clavellatis.

9. Ex ſale tartari, vel cineribus clavellatis in crucibulo fuſis, adjectis carbonibus, reſultat ſpecies hepatis ſulphuris, quale tamen nec nitrum fixum, nec nitrum cauſticum conſtituit.

10. Sal tartari & nitrum cauſticum cum ſpiritu vini rectificatiſſimo tincturam largiuntur, quod vero nec nitrum fixum, nec cineres clavellati, nec iſtud ſal tartari extemporaneum, quod ex 2 partibus nitri & 1 parte tartari paratur, depromunt.

Has quidem *differentias* laudatus D. D. *Hoffmannus advertit, ſed non adduxit, unde hæc eveniant, qua in re differentia hæc ſita ſit, an, & quomodo iſta meliorari & corrigi queant, multo minus quomodo hæc adeo differentia ab ipſo reperta ſalia alcalino-fixa penituſque æqualia reddi poſſint,* cum tamen omnia & ſingula naturali ordine procedant, differentia non adeo difficulter percipi & facile corrigi, & unum ſal alteri æquiparari poſſit, adeo ut *primum* ne unicum quidem phænomenon, ex omnibus ſupra allegatis, uni vel alteri

alteri ſali ſingulare exiſtat, & *ſecundo* inter omnia pura fixa alcalica ſalia nullum aliud diſcrimen amplius, niſi circa gradus cauſticitatis adverti debeat.

(*a*) Affuſum oleum vitrioli in nullo dictorum ſalium ſingularem, ſed ſemper eundem vaporem & fœtorem producere debet.

(*b*) Omnia hæc ſalia æqualiter in clarum & pellucidum vitrum redigi debent.

(*c*) Singula etiam ſpiritum vini rectificatiſſimum pulchro colore tingere debent, & ſic porro.

Sic non neceſſum eſt mirari, *quod oleum vitrioli ex nitro fixo*, vel *ex ſale tartari extemporaneo*, *quod cum* 2 *partibus nitri* paratum fuit, *ſpiritum nitroſum ejiciat*, dum, ſi hoc apparet, in ejuſmodi ſale Alkali neceſſario *adhuc* quædam *nitri crudi portio* ineſt, unde exundantes ex eo fumi (qui nihil aliud quam verum ſpiritum nitri conſtituunt) adeo naturales ſunt, ac ſi Glauberiana methodo oleum vitrioli nitro crudo affunditur, cum e contra utique ex *ſale tartari vulgari*, *ex cineribus clavellatis*, *aliiſque* ejus generis *alcalinis ſalibus quibus nitrum non accedit*, imo *N. B.* quibus non ſuperflue accedit, etiam *nullus ſpiritus nitri* liberari, vel fumus nitroſus exſpectari poteſt.

Hæc res quo tanto certius pateat, recipiatur tantum *idem nitrum fixum*, *vel idem ſal tartari extemporaneum*, à quo ab affuſione olei vitrioli fumus nitroſus apparet, idque denuo cum uno vel alio ſubjecto inflammabili Regni vegetabilis commiſceatur, *e. g.* nitrum fixum *cum majori* carbonum *quantitate*, & ſal tartari extemporaneum *cum copioſiore tartaro* conjungatur, & deflagret ut ante, vel majoris certitudinis cauſa

cauſa proportio carbonum, vel tartari adhuc plus augeatur, quo ſuperfluum antea, & adhuc crudum exiſtens nitrum plus inflammabilis terræ reperiat, quacum incendatur & alcaliſetur, *ut* per conſequens *nihil nitri crudi amplius reſtare poſſit*, tum revera ex hoc recollecto ſale, ab affuſione olei vitrioli, *nullus* ſpiritus nitroſus amplius, ſed potius plane alii vapores effumabunt.

Quod *oleum vitrioli cum ſale tartari* fœtorem ſpiritui nitri plane diſſimilem, nigricantem cuticulam, & obſcuram ſolutionem efficiat, hoc a nulla alia re, niſi *a* ſuperfluis adhuc *in ſale tartari reſiduis empyreumaticis* partibus unice dependet; quod ſi ſal tartari ab iſtis partibus decenti modo repurgatum eſt, tum itidem nec fœtor amplius, nec nigricans ſubſtantia, utpote *quæ oleum vitrioli cum omnibus oleoſis contrahit*, apparebunt: unde ex *cineribus clavellatis*, quia iſti, mediante calcinatione, *ab oleo empyreumatico* magis *liberati* ſunt, ut & ex *puro ſale tartari*, ſi ſufficienter calcinatum eſt, ejuſmodi nigredo nunquam apparet, nec demonſtrari poterit, ſed ab affuſione olei vitrioli omnia clara, & albida permanent.

Simili ratione *hoc oleum empyreumaticum in ſale tartari* unica exiſtit cauſa, quare cum arena clarum pellucidum vitrum non largiatur; ſimul ac ſuperflua hæc oleoſa ſubſtantia ipſi dempta fuit, tum eodem modo, adeo aptum & commodum eſt ad pellucidum vitrum conficiendum, ac *cineres clavellati*, *vel ſal tartari extemporaneum* ipſum: hanc rem declarat & confirmat, quod ſub ejus præparatione, durante detonatione cum nitro, *omnis oleoſa tartari ſubſtantia combuſta & deſtructa* eſt: unde hoc Sal Alkali, quamvis tartarus ad ejus præparationem acceſſerit, per conſequens eodem modo vitrum clarum efficit, quam cineres clavellati, ad quos nihil de tartaro aſſumitur.

Quinetiam hoc in tartaro adhuc præſens, vel alio quoque modo ſali alcalino conciliatum *Phlogiſton* utpote quod tantum & unice [prout jam ſæpius monui] *ad cauſticitatem* confert, eſt ſubſtantialis iſta materia, quæ ſpiritui inflammabili rectificatiſſimo *tincturam* conciliat, quanquam etiam ex parte ſpiritus ardens, qua menſtruum, ſi nempe ille *olei dives* ſit, non parum ad hoc contribuat, & *tinctura tanto magis acceleretur, & augeatur.* Quid mirum igitur, ſi ex ſale tartari extemporaneo cum 2 & 3 partibus nitri parato (quippe per quod omne inflammabile, & ad tincturam producendum abſolute neceſſarium deſtruitur) nullam tincturam recipias?

VII. *De relatione Salium Alcalino-fixorum, ad alia mixta chymica, eorumque uſitata hactenus applicatione ad Chymiam.*

QUanquam ſub definitione horum ſalium dixerim, ea conſiſtere ex terra, in qua parum fixioris vel ultimo magis concentrati ſalis acidi, & inflammabilis, mediante igne, toſtione quaſi & aſſatione impactum eſt, attamen eodem tempore ſimul adduxi, ut ex ipſis definitionis verbis, PARUM VEL ALIQUID, apparet, ſuperfluum ſive acidum, ſive inflammabile, imo ipſas terreſtres ſuperfluas partes, non modo non neceſſaria, ſed, & in reſpectu puritatis & perfectionis, quas ejuſmodi ſal requirit, præjudicioſa & nociva eſſe.

Quod ſi purum quoddam Sal Alcali-fixum, ſive de induſtria, ſive per accidens, cum ſatis notabili & aucta portione unius antedictarum conſtituentium partium, ſive ſit nimium acidi, ſive nimium inflamma-

bilis, ſive nimium partium terreſtrium, vel cum duobus horum ſimul, denuo tractatur & commiſcetur; tum novum hoc commixtum rurſus, *non modo aliam* plane *denominationem*, ſed & *plane alias qualitates & effectus*, ac antea ſolum Sal Alcali habuit, ſortitur.

Nam, ſi Sal Alcali-fixum cum ſale acido tam diu commiſcetur, donec, poſt remiſſionem effervescentiæ, & ſeparationem aquæ, utpote quæ tantum pro vehiculo ſolutionis inſerviit, ſyrupum violarum, ſi ejus aliquid admiſcetur, in ſuo colore non alteret, eumque nec rubrum, nec viridem reddat, tum appellatur *nova hæc mixtio ſal medium*, *ſal ſalſum*, vel *ſal neutrum*. Quod ſi acidum minerale ad hoc adhibitum fuit, tum novum ejuſmodi mixtum facile *in cryſtallos* concreſcit; ſi vero acidum vegetabile uſurpatum fuit, tum *difficulter*, *vel plane non cryſtalliſari* poteſt.

Cum autem in chymia *valde diſtincta ſalia acida* occurrant, proinde etiam juxta indolem iſtorum acidorum [ſi unum, vel alterum eorum, cum Sale Alcalino-fixo uſque ad ſaturationem unitum eſt] exinde productum *ſal medium* ordinario *denominationem accipit*, e. g.

1. Si Sal Alcali-fixum *cum acido vitriolico*, *ſeu ſulphureo*, ita commiſcetur, ut *cryſtalli* exinde emergant, tum ex his utriſque obortum cryſtallinum ſal medium plerumque *tartarus vitriolatus*, vel *ſal polychreſtum* vocatur.

2. Si Sal Alcali-fixum, *cum acido nitri* commiſcetur, & cryſtalliſatur, perfectum inde *nitrum* cryſtallinum exoritur, quod *nitrum regeneratum*, vel etiam *tartarum nitratum* appellare conſueverunt.

3. Si *cum acido ſalis communis* ſaturatur, fit inde *ſal commune regeneratum*, ita dictum *ſal embryonatum*, vel *digeſtivum* Sylvii.

4. *Cum acido aceti* fit *terra foliata tartari*, ſeu, ſic dictum *arcanum tartari.*

5. *Cum acido tartari* oritur *tartarus ſolubilis*, ſeu *tartarus tartariſatus.*

6. *Cum ſucco citri tartarus citratus.*

7. *Pars alcalina*, quæ *in ſale communi* reſidet, *cum acido vitriolico* ejuſmodi ſal medium conſtituit, quod *ſal mirabile* Glauberi vocant.

8. Quod ſi *pars alcalina nitri cum* dicto *acido vitriolico* commiſcetur, ita ut ex his duobus ingredientibus *cryſtallinum ſal medium* paretur, illud, quanquam in fundamento à tartaro vitriolato nihil differat, aliud tamen nomen recipit, dum ſcilicet ab innumeris annis *arcanum duplicatum*, vel *panacea Holſatica* appellatur.

9. Quod ſi vero ordinariis alcalinis plantarum ſalibus tantum ſuperfluum quicquam acidi, ſive à parte vegetabilis ipſius, ſive aliunde accedat, tum communiter inde *ſal cryſtallinum plantarum lixivioſum* oritur.

Si *Sal Alkali-fixum* cum *inflammabili* quodam miſceatur ſive ſint pinguedines, ſive expreſſa, quin & certis ſub enchireſibus deſtillata olea, exſurgit inde pro primo [uti notum eſt] SAPO, deinde vero etiam *ſal*

volatile & ſpiritus urinoſus; quod ſi vero olei empyreumatici animalis quippiam accedit, tum hoc, cum eo etiam tantum imprægnatum, Sal Alcali, præ inflammabili vegetabilium, in curioſis quibuſdam laboribus non parum ſeſe diſtinguet.

Si bituminoſum & acidum vitriolicum mixta [nempe *in ſulphure* communi] cum Sale Alcalino-fixo concurrunt, gignitur inde *hepar ſulphuris*.

Denique, ſi purum Sal Alkali-fixum in igne, cum terra ſaturatur, puta pellucida, ut *arena* communi, *ſilice*, *pyrite*, *glarea*, & ſimilibus, tum non tantum *ſubtilis ſpiritus acidus* inde extorquetur, ſed & totum mixtum convertitur in pellucidam & tranſparentem, in igne quidem adhuc fuſibilem, in aqua vero amplius *indiſſolubilem terram*, nempe *vitrum*, vel etiam cum aliis additamentis in *porcellanam*.

In genere Salia Alcalia-fixa, non facile *ſeſe uniunt*, vel hæc ſalia non facile quicquam *diſſolvunt*, quod non vel *inflammabilitatem*, vel aciditatem quandam continet, & *unum ſemper lubentius & intimius quam alterum*.

1. Sic Salia Alcalia-fixa facile quidem *diſſolvunt ſulphur* commune, quippe in quo *inflammabile & acidum* unita occurrunt, verum *facile* quoque ab eo rurſus *ſeparantur* & liberantur.

2. Facile quoque diſſolvunt, & ſeſe uniunt cum *axungiis*, *pinguedinibus* & *oleis expreſſis*, & communicant pinguibus hiſce materiis *diſpoſitionem* ſeſe cum ipſis prompte *in aqua ſolvendi*, & cum aqua ſeſe uniendi, cum alias iſtæ abſque Alcali-fixo unionem cum aqua omni modo fugiant & detrectent.

3. Salia fixa ſolvunt, & uniunt ſe quoque tandem cum *oleis deſtillatis* eſſentialibus, quamvis *paulo difficilius*.

Et

Et eadem cum differentia horum jam memoratorum duorum generum oleorum, eorumque faciliori vel difficiliori combinatione cum Alcali, *ſeparatio* quoque eorundem ſuccedit, dum Salia hæc fixa a pinguedinibus, axungiis & oleis expreſſis perquam *facile*, & ab oleis æthereis, vel eſſentialibus, contra perquam *difficulter*, *vel plane non* ſeparari queunt, præcipue ſi ſemel intime cum iis unita, & utraque *in perfectum ſaponem* redacta fuere.

4. *Separatio ex vitris* equidem *tarde* aliquatenus ſuccedit, interim poſſibilis tamen eſt factu, quamvis in uno citius quam in alio (præ reliquis in *vitro ſilicum* omnium *facillime*) dummodo denuo cum Alcali ſecundum artem miſceantur, & debito modo tractentur.

5. *Cum ſalibus acidis* hæc Salium Alcalino-fixorum *unio & ſolutio* fere omnium *facillime & promptiſſime* ſuccedit, & quidem *triplici modo*;

(*a*) Vel *miſcendo*, ſi utraque ſimpliciter abſque intermedio conjungantur;

(*b*) Vel *præcipitando*, ſi vel (α) ſal acidum, vel (β) ſal alcalinum fixum antea cum alio quodam corpore commixta fuere;

(*c*) Vel etiam *abſque præcipitatione*, dum ſal acidum equidem itidem antea cum alio quodam commixtum fuit, ſed hoc in acido ſolutum per præcipitationem exinde non ſeparatur.

1. *Miſcendo* peragitur hæc unio, ſi Sal Alkali fixum in aqua ſolutum, vel etiam quod per ſe in deliquium abiit,

abiit, cum ſpiritu, vel liquore quodam acido confunditur, prout in elaboratione diverſorum ſupra adductorum ſalium mediorum videre licet, *e. g.* in præparatione terræ foliatæ tartari, tartari tartariſati, nitri regenerati, tartari vitriolati ex ſpiritu vitrioli & oleo tartari per deliquium, *&c.*

2. *Præcipitando* abſolvitur hæc unio (α); ſi *ſal acidum antea cum quodam* (A) *metallico*, vel etiam (B) *animali* combinatum & ſolutum fuit, id quod multiplici ratione, vel per accidens, vel de induſtria, fieri poteſt, & in Chymia Pharmaceutica ſæpius occurrit. (A) *e. g.* in præparatione auri fulminantis, in qua, ſi Sal Alcali ſolutum, in aquam regiam auro ſoluto impræg-natam, infunditur, unio Salis Alcalici cum utriſque acidis (ſcilicet nitri & ſalis) præcipitando, vel cum proſtratione auri, contingit. Porro apparet hoc in præparatione mercurij præcipitati albi, in elaboratione tartari vitriolati Tachenii, & aliis metallicis præcipitationibus permultis. (B) circa *animales* ſolutiones videre licet ejuſmodi unionem Salis Alcalici cum acido itidem præcipitando factam, *e. g.* in præparatione magiſterii cornu cervi, aliarumque partuim animalium. (β) Alia ex parte peragitur hæc unio modo præcipitationis, *e. g.* in præparatione ſulphuris antimonii ſic dicti aurati, in qua *Sal Alcali primum* ſolutis ſulphureis partibus imprægnatum deprehenditur, quod tam cum affuſo ſale acido ſeſe unit, ſolutum vero antea ſulphur præcipitando deſerit; diſpaleſcit hoc porro, ſi commune ſmegma in aqua ſolutum cum acido præcipitatur, & hoc fit ubique, ubi craſſe pinguia reſinoſa, vel ſulphurea, cum Sale alcalino fixo antea ſoluta & combinata fuere, poſtea vero cum acido præcipitantur.

3. Tertia methodus unionis, quæ *abſque præcipitatione*, nec tamen ſimpliciter miſcendo abſolvitur, dum adhuc intermedium quoddam ſimul adeſt, *duplici modo* fieri poteſt;

α. Vel

α. Vel *ſi ſal acidum antea cum ſale volatili urinoſo combinatum, & in ſal ammoniacale redactum fuit*, ubi, ſi huic ſali volatili medio Sal Alkali fixum adjungitur, ſal acidum, præcipue ſi lenis tantummodo calor applicetur, repente novo huic advenienti alcali fixo ſeſe aſſociat, & deſerit ſal alcali volatile, quod antea continebat, quod tum dicto leni calore, tanquam deſertum & in ſe perquam volatile corpus, facile expelli poteſt ;

β. Vel ſiſtitur etiam hic unionis modus, *ſi Sal Alcali antea cum debiliori acido ipſo combinatum fuit*, & fortius acidum affunditur, hoc novum mixtum in retorto vaſe igni exponitur : tum enim debilius acidum cogitur abſolute fortiori cedere, & deſtillando ſeparatur, quod in deſtillatione ſpiritus nitri & ſalis fumantis, aliorumque luculenter patet.

Quanquam autem hæc Salis Alcali fixi cum omnibus ſalibus acidis combinatio perquam *amice quaſi* peragitur, inde tamen *non exiſtimandum, ac ſi cum omnibus ÆQUALITER contingat*, vel cum uno eodem modo ac cum altero, *æquali firmitudine* ſeſe uniat. Minime! ſed & hac in re *ingens occurrit differentia*, dum in uno vel altero præferentia (ut barbare loquar) ſeu *propinquior affinitas*, vel prout cuilibet denominare placet, *inter Sal Alkali fixum* & hoc vel illud *ſal acidum* obſervatur. Et cum hæc *affinitatis ſcala* in Chymia *non parvi emolumenti*, ejuſque notitia Chymico practico perquam neceſſaria ſit, proinde de ea, iis præcipue, quibus iſta adhuc forte ignota eſt, quædam in medium proferre ſuperſedere non poſſum, præprimis cum ex combinatione Salis Alcalino-fixi cum ſalibus acidis, & ex ſcala iſta, quam jam producturus ſum,

ſum, major *vis & fortitudo unius acidi præ altero*, omnium optime annotari & dijudicari poſſit, nempe *in quantum ad combinationem cum alkali fixo ſeſe refert.*

Purum ergo *Sal Alcali fixum* omnium optime & *firmiſſime* ſeſe combinat cum fortiſſimo præ omnibus acido primigenio, puro puto, & *fixiori acido vitriolico & ſulphureo:* quod ſi hoc acidum adhuc cum principio inflammabili, ut communi ſulphure, commixtum prodit, tum intima ejusmodi unio cum alcali non celebratur, ſed ſuperficialis tantum ſolutio ſeu cohæſio emergit, &, ut ſupra jam notavi, fit *nudum hepar ſulphuris*, ex quo alcali *facillime*, imo *cum debiliſſimo acido vegetabili rurſus ſeparari poteſt.*

Bonaex parte *firmius* acidum hoc ſulphuris Sali Alcalino cohæret, ut ad minimum a debiliſſimo acido liberari non poſſit, ſi *portionem* tantum *inflammabilis*, quocum conjunctum fuerat, per deflagrationem *amiſit*, quod clare ſatis patet, ſi durante deflagratione ſulphuris, Sal Alcalinum fixum ea ratione applicatur, ut volatilis ſpiritus ſulphuris ei intricetur & irretiatur; interim tamen cohæſio hæc *non* eſt *ſatis firma*, dum volatilis hic ſpiritus *per* propriæ quoque indolis, purius tamen, ab inflammabili plane depuratum, & magis fixum & *concentratum*, *acidum vitriolicum* rurſus inde expelli, & à Sale Alcalino fixo liberari poteſt, ex alia ratione nulla, quam *quia* bona ex parte *adhuc de principio inflammabili participat*, ex quo acidum iſtud adhuc volatile & ſubtile, per conſequens non ita purum & fixum exiſtit, ac oleum vitrioli rectificatum; ſi vero ejuſmodi ſpiritus ſulphuris volatilis tantum per aliquod tempus *libero aëri* exponitur, tum tenerum hoc inflammabile plane *diſſipatur* & *exhalat*, reſtante è contra itidem puro, fixo, & cum alio ex vitriolo, vel alumine, deſtillato acido, in

omnibus probis *æquali*, & in nulla re diverſo acido, quod tum cum Sale Alcali fixo, eadem ratione ac aliud purum, fixum, acidum vitriolicum, ſeſe quam *firmiſſime* commaritabit.

Poſt hoc acidum ſulphureum, vel vitriolicum, unit ſeſe noſtrum Sal Alcali fixum lubentiſſime *cum acido nitri*, ſeu ſpiritu nitri.

Et poſt hoc cum *acido ſalis communis*, ſeu *marini*.

Denique omnium debiliſſime *cum acidis vegetabilium*, ut acido aceti, tartari, ſpiritu lignorum, ſpiritu ſacchari, ſucco citri, vino Rhenano, *&c.*

Ex his igitur ſufficienter addiſci poteſt, qua ratione novæ ſemper combinationes Salis Alcalino-fixi cum ſale acido perpetrari, & idem alcali aliquoties debiliori acido per fortius rurſus ſurripi poſſit, ubi autem in *ſcala hac* non deviandum eſt. Nam ſi Sal Alcali fixum cum puro acido vitriolico combinatum foret, tum utique nullum acidum ex omnibus aliis potens eſſet, hoc Sal Alcali fixum ipſi rurſus eripere, quia nimirum hoc eſt fortiſſimum omnium, & omnia reliqua acida ſunt multo debiliora, utpote quæ ſingula contraria ex parte ab acido vitriolico ſeparari poſſunt.

Equidem D. D. *Stahl* etiam ad hoc medium quoddam demonſtravit, qua ratione Sal Alkali ex acido vitriolico rurſus liberari poſſit: verum hoc non fit mediante alio acido, ſed mediante additione principij inflammabilis, paucis per artificioſam ſulphuris formationem, per conſequens requiſito ad hoc labore in igne. Laudatus D.D. *Stahl* hunc mihi, *Anno* 1718, cum tunc temporis *Lutitiæ Pariſiorum* adhuc degerem, ſingularem honorem exhibuit, ut hujus liberationis cauſa *novum* plane *problema*, ad iſtam ſulphuris geneſin plane non applicabile, in conſiderationem & ſolutionem per literas mihi proponeret; continetur autem ſequentibus verbis: *Qua ratione Sal Alcali fixum ab*

acido

acido vitriolico, prout utraque ſub figura cryſtallini tartari vitriolati apparent, in ſola cavitate manus, & unico in momento liberari poſſit ? Quæ momenta alias inaudita adhuc fuere, quod poſſibilia exiſtant, & forte ad hoc uſque tempus adhuc nemini præter laudatum D. *Stahlium* & me, vel cui prior forte iſtud manifeſtavit, nota erant. Dominus *Geoffroy* ſenior, profeſſor Chymiæ Pariſienſis, cui problema hoc tum temporis communicabam, Anno 1720, in hiſtoria academiæ ſcientiarum Gallicæ, illud imprimi curavit, & *putativam* hujus problematis *ſolutionem* annexuit; ſed vir hic quam amicus meus perdilectus, *rem plane non tetigit*, ſed penitus *aberravit*, dum deſideratam hanc Salis Alcalini ſeparationem, de formatione ſulphuris diu jam cognita & publice nota, explicat & applicat; hæc vero ſulphuris productio plane *non in unico momento, multo minus in ſola cavitate manus, ſed in crucibulo igne candente fit*, vel perpetrari debet.

Circa combinationes præcipitatorias, in quibus metalla ſoluta fuere, adhoc obſervandum eſt, quod Sal Akali fixum, durante unione cum acido, cadenti ad fundum *metallo alterationem* quandam *imprimat*, quæ non raro tantam mutationem involvit, ut talia cum ipſo præcipitata metalla perquam *difficulter in priſtinam malleabilem & fluxilem*, ſeu fuſibilem metallicam *formam* reduci ſeſe patiantur ; cujus rei (ut aliquid tantummodo adducam) etiam ferrum, quod ex commixtione vitrioli martis cum Sale Alcalino-fixo, in præparatione tartari vitriolati *Tachenij*, ad fundum cadit, ſufficiens teſtimonium perhibet.

Solent etiam noſtra *Salia Alkalina fixa*, præter memorata ſuperius corpora, per ſe adhuc diverſa *corpora metallica ſolvere*, quanquam pro hac intentione aliqualis cauſticitatis gradus requiratur.

(*a*) Solvunt proinde calcem *plumbi*, vel etiam plumbum tenerè raſum.

(*b*) Solvunt itidem ſubtilem raſuram *cupri*, vel etiam cuprum è vitriolo præcipitatum, quin & cuprum in viridi æris contentum.

(*c*) Sic & *ſtannum* ſolvunt;

(*d*) Ut & *regulum antimonij*, cum quo in calcem, imo etiam ultimatim, ſi fortiſſimo igne torquentur, plane in ſuccinei coloris vitrum convertuntur.

(*e*) *Ferrum* ſolvunt duplici ratione;

(1.) Vel dum cum nitro detonatur, & nitrum cauſticum ejus ope producitur;

(2.) Vel etiam, ſi puram ſolutionem Salis Alcali fixi ſolutioni martis cum ſpiritu nitri antea factæ infundo, prout hoc fuſius in Diſſertatione quadam ſub D. D. *Stahlio* de hac materia evolvi poteſt.

Quod ſi vero fixum noſtrum Sal Alcali *antea ſulphure* bene *imprægnetur*, tum *omnia metalla*, (quædam etiam ſemi-metalla) nimirum *cuprum*, *ferrum*, *plumbum*, *regulus antimonij*, imo etiam *ſtannum & aurum* cum ipſo diſſolvi poſſunt.

Denique, ut coronidem imponamus, adhuc meretur, quod Salia Alcalino-fixa, Salibus Alcalino-volatilibus *ſiccam conſiſtentiam* conciliant, quod corpora alcalino-terrea non faciunt.

Solvunt etiam hæc fixa ſalia tam ex ſpiritibus urinoſis, quam ex ſpiritibus inflammabilibus quoque ſu-

perfluam, & ſuperficie tenus tantum adhærentem, *oleoſam* ſubſtantiam.

Quibus uſibus ulterius in Chymia adhiberi ſoleant, partim jam ſatis notum eſt, partim etiam occaſione variorum aliorum laborum jam à me pertractatum fuit, unde nec de his, nec de reliquis diverſis putatitiis, & injuria ſic æſtimatis, revera autem *falſis Salibus Alcalinis*, quippe de quibus adhuc unum & alterum monendum, ſi non fortaſſe totum capitulum annectendum eſſet, ulterius quicquam adducam ; ſed ne pertractatio hæc nimium excreſcat, finem hiſce imponam.

Berolin. Menſis Sept. 8vo. 1725.

CASPAR NEUMAN,

Chymiæ practicæ Profeſſor Regius.

II. *Observations made at* Southwick, *in the County of* Northampton, Long. *West from* London, 00 deg. 30 min. Lat. 51 deg. 58 min. *nearly, with a thirteen foot* Telescope, *whose Aperture was* 2.4 *Inches, and Charge* 2.5 *Inches, all by apparent Time. By the ingenious* George Lynn, *Esq;*

1724. *Novemb. 8th*, 7^h 37′ 7″ the first Satellite of *Jupiter* began to emerge: The same Day at 6^h 24′ 20″. The third Satellite began to immerge,

1725. *July 31st*, 10^h 43′ 20″. The third Satellite immerged, that is I quite lost Sight of it, (at a little above a Semidiameter from *Jupiter*) but it began sensibly to abate of its Light above three Minutes before.

August 9th, 11^h 51′ 20″ I lost Sight of the second Satellite; but it began sensibly to abate of its Light, about two Minutes before.

August 18th, 9^h 25′ 50″. The first Satellite immerged very near *Jupiter*'s body.

The same Night, both my self and Son plainly saw the Shadow of the third Satellite pass over *Jupiter*'s body, like a small black Patch, tracing along the Middle of his bright Belt, above the most Southern Black one, and was in his Axis, as near as I could guess by the Eye, at 10^h 25, or 30′.

N. B. We could see it for about the middle Half of its Track, but not near *Jupiter*'s Edges.

Octob. 11th, 6^h 31′ 45″. The third Satellite began to emerge, and was full three Minutes and a half, before it was at its greatest Lustre, which I could then

then well judge of, by comparing it with the firſt Satellite, which was juſt a little above it, but nearer *Jupiter*. It came out of the Shadow, about half a Diameter from *Jupiter*'s Edge.

Decemb. 26th, 5^h 51′ 12″ the ſecond Satellite began to emerge.

1725-6, *Jan. 5th*, 6^h 28′ 30″. The third Satellite began to emerge.

1724 *June 23d*, 10^h 15′ *Saturn* followed a Star (in *Senex*'s *Zodiack*, but without any diſtinguiſhing Mark) 51″ and an half of Right Aſcenſion in Time, and declin'd from it South 40″.

June 25th, 10^h 0′ *Saturn* followed the ſame Star, 13″ of Right Aſcenſion in Time, and declined from it South, 3″ or 4″ only,

1725. *Decemb. 17th*, 8^h 0′ *Jupiter* preceded φ *Aquarii* 4″ and an half of Right Aſcenſion in Time, and declin'd from it South 11′ 45″.

N. B. When two of *Jupiter*'s Satellites are paſſing by one another, the one approaching, the other receding from him (if not too far diſtant from his Body) the Time, when they become equally diſtant from his Limb, may, by the Eye, be very nearly determined, eſpecially when the firſt and ſecond ſo paſs, as by Experience I have found by the above mention'd Glaſs, within leſs than half a Minute in Time, by the Agreement of two good Obſervers.

Therefore the taking the Time of thoſe Paſſages, I mean of the firſt and ſecond Satellites, would be of more uſe in ſettling the Longitude of Places, than the Eclipſes of any of the Satellites, except the firſt, by Reaſon of the Length of Time they take in emerging, or immerging, according to theſe Obſervations.

III. *An Extraordinary high Tide in the River* Thames *obſerv'd by Capt.* THO. JONES.

MARCH the 8th, 1725-6, The *Tide* in the *River Thames*, at *New Crane* in *Shadwell*, flow'd twenty Foot, five Inches and a half, taken by a Level, from that High-water Mark, to Low-water the next Morning, and was four Inches higher than has been known theſe fourty Years.

IV. *Obſervations upon the Tides in the River* Thames, *by Mr.* Henry de Saumarez.

THAT the Uſe of my Inſtrument call'd the * *Marine Surveyor* may yet farther appear, I ſhall here give ſome Experiments I made with it on the River *Thames*, in order to determine the Strength of the Tides of *Flood* and *Ebb*. Were the ſame to be done in the Channel, and on the Sea Coaſt of *Great Britain*, and mark'd in our Charts, I am humbly of Opinion, it would be of no ſmall advantage to our Commerce, and of conſequence a ſufficient Recommendation of the *Marine Surveyor*, if that alone were the Uſe of it.

I am induced the rather to be of this Opinion, in regard I am not inſenſible of the Dangers on the *Caſquets*, in the *Race* of *Alderney*, &c. where rapid Tides and Currents have occaſioned but too many to mourn the Loſs of Friends and Fortunes: As I dwell in the Neighbourhood of theſe Dangers, I have (in manifeſt hazard of my Life) ſurvey'd and taken correct Draughts not only of them, but of the Iſlands of *Guernſey*, *Sarck*, &c. And as I perſuade my ſelf they are as correct, as any Thing that has hitherto appear'd of this kind, it is my intent to publiſh them for the Good of the Publick.

* *Vid.* Philoſ. Tranſact. No. 391.

III. A TABULAR Account, ſhewing the Strength and gradual Increaſe and Decreaſe of the Tides of Flood and Ebb in the River *Thames*, as obſerv'd in *Lambeth* Reach, off of *Mancheſter* Stairs, and in the Middle of the River, with a new Inſtrument call'd the *Marine Surveyor*, on the *9th* of *June*, 1720; It being then Full Moon, and conſequently a Spring Tide. The Movement of the *Machine* 14 Inches under Water.

FLOOD.

The Time of Flood.		The Depth of the River,		The Run of the Current in every 15 Min.	The whole Run of the Current to the Times expreſs'd in the firſt Column.	The ſame reduced to Statute Miles of 5280 feet, or 528 Revolutions of the *Machine*.			The Reduction into Engliſh maritime Miles of 6000 feet, or 600 Revolutions.		
H.	M.	Ft.	In.	Feet.	Feet.	M.	Pts.	Rev.	M.	Pts.	Rev.
	15	5		110	110			11			11
	30	6		590	700			70			70
	45	6	9	1100	1800		¼	48		¼	30
1		7		1490	3290		½	55		½	29
1	15	8		1870	5160		¾	120		¾	66
	30	9		2230	7390	1	¼	79	1		139
	45	10		2500	9890	1	¾	65	1	½	89
2		11	6	2660	12550	2	¼	67	2		55
2	15	13		2730	15280	2	¾	76	2	½	28
	30	14		2740	18020	3	¼	86	3		2
	45	14	9	2720	20740	3	¾	94	3	¼	124
3		14	9	2570	23310	4	¼	87	3	¾	81
3	15	14	10	2220	25530	4	¾	45	4	¼	3
	30	14	9	1820	27350	5		66	4	½	35
	45	14		990	28340	5	¼	62	4	½	134
	50	13	9	130	28470	5	¼	75	4	½	147

EBB.

The time of Ebb.		The depth of the River.		The Run of the Current in every 15 Min.	The whole Run of the Current to the Times expressed in the first Column.	The same reduced to Statute Miles of 5280 feet, or 528 Revolutions of the Machine			The reduction into Englisſh maritime Miles of 6000 feet, or 600 Revolutions.		
H.	M.	Ft.	In.	Feet.	Feet.	M.	Pts.	Rev.	M.	Pts.	Rev.
	15	12	9	280	280			28			28
	30	12	3	1140	1420		1/4	10			142
	45	11	10	1900	3320		1/2	68		1/2	32
1		11	4	2080	5400	1		12		3/4	90
1	15	11	2	2120	7520	1	1/4	92	1	1/4	2
	30	10	9	2120	9640	1	3/4	40	1	1/2	64
	45	10	4	2170	11810	2		125	1	3/4	131
2		10		2130	13940	2	1/2	74	2	1/4	44
2	15	9	6	2060	16000	3		16	2	1/2	100
	30	9	4	2040	18040	3	1/4	88	3		4
	45	9		2020	20060	3	3/4	26	3	1/4	56
3		8	9	1910	21970	4		85	3	1/2	97
3	15	8	6	1900	23870	4	1/2	11	3	3/4	137
	30	8	3	1910	25780	4	3/4	70	4	1/4	28
	45	8		1860	27640	5		124	4	1/2	64
4		7	9	1810	29450	5	1/2	41	4	3/4	95
4	15	7	3	1780	31230	5	3/4	87	5		123
	30	7		1690	32920	6		124	5	1/4	142
	45	6	6	1620	34540	6	1/2	22	5	3/4	4
5		6	3	1570	36110	6	3/4	47	6		11
5	15	6	3	1570	37680	7		72	6	1/4	18
	30	6		1570	39250	7	1/4	97	6	1/2	25
	45	6		1560	40810	7	1/2	121	6	3/4	31
6		5	9	1550	42360	8		12	7		36
6	15	5	6	1500	43860	8	1/4	30	7	1/4	36
	30	5	3	1460	45320	8	1/2	44	7	1/2	32
	45	5		1450	46770	8	3/4	57	7	3/4	27
7		4	9	1430	48200	9		68	8		20
7	15	4	6	1400	49600	9	1/4	76	8	1/4	10
	30	4	3	1380	50980	9	1/2	82	8	1/4	148
	45	4	3	1340	52320	9	3/4	84	8	1/2	232
8		4		1270	53590	10		79	8	3/4	109
8	5	3	10	420	54010	10		121	9		1
	10	3	11	410	54420	10	1/4	30	9		42
	15	4		400	54820	10	1/4	70	9		82
	20	4		380	55200	10	1/4	108	9		120
	25	4	2	300	55500	10	1/2	6	9	1/4	
	30	4	2	270	55770	10	1/2	33	9	1/4	27
	35	4	3	130	55900	10	1/2	46	9	1/4	40
	40			Stagnt.	Stagnant						

IV. A TABULAR Account, Shewing the Strength and gradual Increaſe of the Tides of Flood and Ebb in the River *Thames*, as obſerv'd in *Lambeth* Reach, off of *Mancheſter* Stairs, and in the Middle of the River, with a New Inſtrument call'd the *Marine Surveyor*, on the 18*th* of *June* 1720; It being then the laſt Quarter of the Moon and conſequently a Neap Tide. The Movement of the *Machine* 14 Inches under Water.

FLOOD.

The Time of Flood.		The Deph of the River.		The Run of the Current in every 15 Min.	The whole Run of the Current to the Times expreſs'd in the firſt Column.	The ſame reduced to Statute Miles of 5280 feet, or 528 Revolutions of the *Machine*.			The Reduction into Engliſh maritime Miles of 6000 feet, or 600 Revolutions.		
H.	M.	Ft.	In.	Feet.	Feet.	M.	Pts	Rev.	M.	Pts.	Rev.
	15	4		220	220			22			22
	30	4	3	520	740			74			74
	45	4	9	900	1640		¼	32		¼	14
1		5	3	1030	2670		½	3		¼	117
1	15	5	9	1020	3690		½	105		½	69
	30	6	1	1160	4850		¾	89		¾	35
	45	7		1450	6300	1		102	1		30
2		7	9	1640	7940	1	½	2	1		44
2	15	8	1	1830	9770	1	¾	53	1	½	77
	30	9		1920	11690	2		113	1	¾	119
	45	9	6	2070	13760	2	½	56	2	¼	26
3		10		2170	15930	3		9	2	½	
3	15	10	4	2070	18000	3	¼	84	3		
	30	11	3	1960	19960	3	¾	16	3	¼	46
	45	11	4	1890	21850	4		73	3	½	85
4		11	9	1700	23550	4	¼	111	3	¾	105
4	15	11	6	1300	24850	4	½	109	4		85
	30	11		730	25580	4	¾	50	4	¼	8
	35	11		70	25650	4	¾	57	4	¾	15
	40			Stagnt.	Stagnant.						
	45	10	10	dit.	dit,						
	50	10	9	dit.	dit.						

EBB.

The Time of Ebb.		The Depth of the River.		The Run of the Current in every 15 Min.	The whole Run of the Current to the Times expreſs'd in the firſt Column.	The ſame reduced to Statute Miles of 5280 feet, or 528 Revolutions of the *Machine*.			The Reduction into Engliſh maritime Miles of 6000 feet, or 600 Revolutions.		
H.	M.	Ft.	In.	Feet.	Feet.	M.	Pts	Rev.	M.	Pts.	Rev.
	15	10	6	610	610			61			61
	30	10		1340	1950		¾	63		¼	45
	45	9	9	1520	3470		½	83		½	47
1		9	3	1650	5120		¾	116		¾	62
1	15	9		1750	6870	1	¼	27	1		87
	30	8	6	1730	8600	1	½	68	1	¼	110
	45	8		1700	10300	1	¾	106	1	½	130
2		7	9	1710	12010	2	¼	13	2		1
2	15	7	3	1710	13720	2	½	52	2	¼	22
	30	7	1	1710	15430	2	¾	91	2	½	45
	45	6	9	1710	17140	3		130	2	¾	64
3		6	7	1680	18820	3	½	34	3		82
3	15	6	4	1670	20490	3	¾	69	3	¼	99
	30	6		1570	22060	4		94	3	½	106
	45	5	9	1500	23560	4	¼	112	3	¾	106
4		5	8	1480	25040	4	½	128	4		104
4	15	5	3	1440	26480	5		8	4	¼	98
	30	5	2	1430	27910	5	¼	19	4	½	91
	45	5		1420	29330	5	½	29	4	¾	83
5		5		1430	30760	5	¾	40	5		76
5	15	4	10	1420	32180	6		50	5	¼	68
	30	4	6	1430	33610	6	¼	61	5	½	61
	45	4	4	1420	35030	6	½	71	5	¾	53
6		4	1	1380	36410	6	¾	77	6		41
6	15	3	11	1360	37770	7		81	6	¼	27
	30	3	11	1340	39110	7	¼	83	6	½	11
	45	3	10	1230	40340	7	½	74	6	¾	134
7		3	10	1070	41410	7	¾	49	6		91
7	15	3	11	530	41940	7	¼	102	6	¼	144
	20	4		20	41960	7	¾	104	6	¼	145
	25			Stagnt.	Stagnant.						
	35	4	3	dit.							

V. A New and Exact TABLE, Collected from several Observations, taken in four Voyages to *Hudson's Bay* in North *America*, from *London*: Shewing the Variation of the *Magnetical Needle*, or Sea *Compass*, in the Path-way to the said *Bay*, according to the several *Latitudes* and *Longitudes*, from the Year 1721, to 1725. By Mr. *Christopher Middleton*.

Lat.		Long.		Vari.		Lat.		Long.		Vari.	
D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
50	00	12	00	14	00	50	00	18	45	17	00
51	00	12	00	14	15	51	00	18	45	17	15
52	00	12	00	14	30	52	00	18	45	17	30
53	00	12	00	14	45	53	00	18	45	17	45
54	00	12	00	15	00	54	00	18	45	18	00
55	00	12	00	15	15	55	00	18	45	18	15
56	00	12	00	15	30	56	00	18	45	18	30
57	00	12	00	15	45	57	00	18	45	18	45
58	00	12	00	16	00	58	00	18	45	19	00
59	00	12	00	16	15	59	00	18	45	19	15
50	00	14	15	15	00	50	00	21	00	18	00
51	00	14	15	15	15	51	00	21	00	18	15
52	00	14	15	15	30	52	00	21	00	18	30
53	00	14	15	15	45	53	00	21	00	18	45
54	00	14	15	16	00	54	00	21	00	19	00
55	00	14	15	16	15	55	00	21	00	19	15
56	00	14	15	16	30	56	00	21	00	19	30
57	00	14	15	16	45	57	00	21	00	19	45
58	00	14	15	17	00	58	00	21	00	20	00
59	00	14	15	17	15	59	00	21	00	20	15
50	00	16	30	16	00	50	00	23	15	19	00
51	00	16	30	16	15	51	00	23	15	19	15
52	00	16	30	16	30	52	00	23	15	19	30
53	00	16	30	16	45	53	00	23	15	19	45
54	00	16	30	17	00	54	00	23	15	20	00
55	00	16	30	17	15	55	00	23	15	20	15
56	00	16	30	17	30	56	00	23	15	20	30
57	00	16	30	17	45	57	00	23	15	20	45
58	00	16	30	18	00	58	00	23	15	21	00
59	00	16	30	18	15	59	00	23	15	21	15

Lat.		Long.		Vari.	
D.	M.	D.	M.	D.	M.
50	00	25	30	20	00
51	00	25	30	20	15
52	00	25	30	20	30
53	00	25	30	20	45
54	00	25	30	21	00
55	00	25	30	21	15
56	00	25	30	21	30
57	00	25	30	21	45
58	00	25	30	22	00
59	00	25	30	22	15
50	00	27	45	21	00
51	00	27	45	21	15
52	00	27	45	21	30
53	00	27	45	21	45
54	00	27	45	22	00
55	00	27	45	22	15
56	00	27	45	22	30
57	00	27	45	22	45
58	00	27	45	23	00
59	00	27	45	23	15
50	00	30	00	22	00
51	00	30	00	22	15
52	00	30	00	22	30
53	00	30	00	22	45
54	00	30	00	23	00
55	00	30	00	23	15
56	00	30	00	23	30
57	00	30	00	23	45
58	00	30	00	24	00
59	00	30	00	24	15
50	00	32	15	23	00
51	00	32	15	23	15
52	00	32	15	23	30
53	00	32	15	23	45
54	00	32	15	24	00
55	00	32	15	24	15
56	00	32	15	24	30
57	00	32	15	24	45
58	00	32	15	25	00
59	00	32	15	25	15

Lat.		Long.		Vari.	
D.	M.	D.	M.	D.	M.
50	00	34	30	24	00
51	00	34	30	24	15
52	00	34	30	24	30
53	00	34	30	24	45
54	00	34	30	25	00
55	00	34	30	25	15
56	00	34	30	25	30
57	00	34	30	25	45
58	00	34	30	26	00
59	00	34	30	26	15
50	00	36	45	25	00
51	00	36	45	25	15
52	00	36	45	25	30
53	00	36	45	25	45
54	00	36	45	26	00
55	00	36	45	26	15
56	00	36	45	26	30
57	00	36	45	26	45
58	00	36	45	27	00
59	00	36	45	27	15
50	00	39	00	26	00
51	00	39	00	26	15
52	00	39	00	26	30
53	00	39	00	26	45
54	00	39	00	27	00
55	00	39	00	27	15
56	00	39	00	27	30
57	00	39	00	27	45
58	00	39	00	28	00
59	00	39	00	28	15
50	00	41	15	27	00
51	00	41	15	27	15
52	00	41	15	27	30
53	00	41	15	27	45
54	00	41	15	28	00
56	00	41	15	28	15
57	00	41	15	28	30
58	00	41	15	28	45
59	00	41	15	29	00

Lat.		Long.		Vari.	
D.	M.	D.	M.	D.	M.
50	00	43	30	28	00
51	00	43	30	28	15
52	00	43	30	28	30
53	00	43	30	28	45
54	00	43	30	29	00
55	00	43	30	29	15
56	00	43	30	29	30
57	00	43	30	29	45
58	00	43	30	30	00
59	00	43	30	30	15
51	00	46	00	29	00
52	00	46	00	29	15
53	00	46	00	29	30
54	00	46	00	29	45
55	00	46	00	30	00
56	00	46	00	30	15
57	00	46	00	30	30
58	00	46	00	30	45
59	00	46	00	31	00
52	00	48	30	30	00
53	00	48	30	30	15
54	00	48	30	30	30
55	00	48	30	30	45
56	00	48	30	31	00
57	00	48	30	31	15
58	00	48	30	31	30
59	00	48	30	31	45
53	00	51	00	31	00
54	00	51	00	31	15
55	00	51	00	31	30
56	00	51	00	31	45
57	00	51	00	32	00
58	00	51	00	32	15
59	00	51	00	32	30
60	00	51	00	32	45
54	00	54	00	32	00
55	00	54	00	32	15
56	00	54	00	32	30
57	00	54	00	32	45
58	00	54	00	33	00
59	00	54	00	33	15
60	00	54	00	33	30
61	00	54	00	33	45

Lat.		Long.		Vari.	
D.	M	D.	M.	D.	M.
54	00	57	00	33	00
55	00	57	00	33	15
56	00	57	00	33	30
57	00	57	00	33	45
58	00	57	00	34	00
59	00	57	00	34	30
60	00	57	00	35	00
61	00	57	00	35	30
55	00	60	00	34	00
56	00	60	00	34	30
57	00	60	00	35	00
58	00	60	00	35	30
59	00	60	00	36	00
60	00	60	00	36	30
61	00	60	00	37	00
57	00	63	00	35	00
58	00	63	00	35	30
59	00	63	00	36	00
60	00	63	00	36	30
61	00	63	00	37	00
62	00	63	00	37	30
59	00	66	00	37	00
60	00	66	00	37	40
61	00	66	00	38	20
62	00	66	00	39	00
63	00	66	00	39	40
60	00	69	00	41	00
61	00	69	00	41	40
62	00	69	00	42	20
60	00	72	00	40	00
61	00	72	00	42	00
61	40	72	00	42	40
62	00	78	00	43	00
63	00	78	00	44	00
63	50	78	00	46	00

Lat.		Long		Vari.	
D.	M.	D.	M.	D.	M.
61	00	75	00	38	00
62	00	75	00	43	00
62	50	75	00	45	00
63	00	81	00	43	00
64	00	81	00	46	00
62	00	82	00	39	00
63	00	82	00	44	00
61	00	84	00	33	45
62	00	84	00	40	00
63	00	84	00	42	00
60	00	86	00	30	00
61	00	86	00	33	00
62	00	86	00	35	00
59	00	88	00	28	00
60	00	88	00	28	40
61	00	88	00	29	20
57	00	90	00	24	00
58	00	90	00	24	30
59	00	90	00	25	00
57	00	94	00	23	00
58	00	95	00	22	30
59	00	95	00	21	00

From Long. 68 Degrees *to* 81. *is in* Hudſon's *Straits, where is the greateſt Variation, and the Compaſs will hardly Traverſe.*

VI. *An Account of ſeveral Experiments concerning the Running of Water in Pipes, as it is retarded by Friction and intermixed Air, ſome of which were made before the Royal Society on* Thurſday *the 5th of* May, 1726. *With a Deſcription of a new Machine, whereby Pipes may be clear'd of Air, as the Water runs along, without Stand-Pipes, or the help of any Hand. By the Rev.* J. T Deſaguliers, LL. D. F. R. S.

HAVING found by ſeveral Experiments in ſmall, that thro' a long Pipe, Water wou'd not be diſcharg'd in the ſame Quantity by a great deal, as it wou'd be thro' a ſhorter of the ſame Bore, the Orifice being at the ſame Depth under the Surface of the Water in a Reſervoir: I made an Experiment upon a Pipe above 1000 Yards in length, and of 1¾ Inch Bore, at his Grace the Duke of *Chandos*'s Houſe at *Cannons*; and found that the Quantity of Water given was much leſs (I think $\frac{11}{12}$ leſs) than it ought to have been according to Monſ. *Mariotte*'s Rules; and that ſomething more than the Friction, on Account of the Length of the Pipe, had retarded the Water; which I found ſince to be Air confin'd in the eminent Parts of the Pipe. A full Account of this Experiment I publiſh'd in my Notes upon *Mariotte's Mouvement des Eaux*, in the *Engliſh* Tranſlation, ſome Years ago.

Conſidering this Matter again lately, I made the following Experiment. Fig. 1. *A* is a Veſſel containing a Cubic Foot in the Inſide, and always kept full

by means of the Pipe *B* running from a larger Veſſel. *CD*, is a ſhort Pipe of $\frac{1}{4}$ of an Inch Bore, two Foot in length, opening into the Bottom of the Ciſtern *A*, and whoſe Orifice *D* is always 10 Inches below the Bottom of *A*.

OGEEEHF, is another Pipe of the ſame Bore, whoſe Orifice *F* is likewiſe 10 Inches below the Bottom of *A*. This Pipe is 113 Yards long, lying along the Ground five Foot below *A*, except the depending Part *OG*, and the aſcending Part *HF*.

When *F* is ſtopped, and (*A* being kept full) the Water runs out at *D*, the Quantity of Water given is 19 Times more than when *D* is ſtopp'd, and the Water runs out at *F*.

The Air confin'd in ſeveral Parts of the long Pipe, is the chief Reaſon of this Difference.

In order to get rid of the Air, which lodging in the Pipe, contracts its Bore, and thereby leſſens the Quantity of Water, which is to be deliver'd at the Iſſue, I made ſeveral Experiments to find whereabouts the Air does lodge, the more eaſily to let it out; one of which was as follows.

I took a Glaſs Pipe as *AB* (Fig. 2.) of about one Inch in Diameter, 12 Foot in length from *P* to *P*; only the Parts *AP* and *PB* at the other End, were of Lead. Then pouring in Water at *A*, till it came up to *B* (ſtopping the End *G*) the Air lodg'd in the eminent Parts of the Pipe at the Places mark'd *CC*, *DD*, and *EE*: But when the Water was ſuffer'd to go out at *G*, the Air came forward towards *G*, and took up the Spaces *c c*, *d d*, and *e e*, contracting the Bore of the Pipe as before, but ſtood forwarder in the Pipe, ſo that it generally happen'd that the Space of Air began upon the upper part of the Eminence of the Pipe

N. B. The Glaſs Pipe may be made of ſeveral Pieces join'd to each other, and to the Leaden Pipes

and

and Funnels, by Braſs Ferrils and Elbows, turning in all manner of Angles. Theſe are not repreſented here.

If the Velocity of the Water is very great, the Air will go even beyond the Eminence of the Pipe.

To let out the Air from the Conduct Pipes, which obſtructs the Running of the Water, I recommend the Experiments which I made, and the Apparatus which I applied to a Wooden Conduct Pipe of nine Inches Bore, which runs a Mile and an half from the Water Engine at *York-Buildings* to a Reſervoir near *Cavendiſh-ſquare*; the Surface of the Water in the Ciſtern at the Water-houſe being ſometimes 15, and ſometimes 20 Foot above the Iſſue at the Reſervoir.

Upon a Part of the Pipe, ſuch as *AB* (Fig. 3.) I fix'd a Leaden Pipe *DF* of 2 Inches in the Bore, by means of 3 Ferrels, or ſhort Communication-Pipes; the firſt at *D*, juſt beyond the Beginning of the Space *CC*, that us'd to be fill'd with Air in the running of the Water, the Second in the Middle of the Leaden Pipe, and the Third at the End of it; the Length of the Pipe itſelf being from 12 to 24 Feet, according to the Steepneſs of the Deſcent, the ſhorteſt Pipe being ſufficient where the Deſcent is very quick. From the Middle of the Leaden Pipe above-mention'd (call'd a Rider, from its being laid along on the Main or Conduct Pipe) there goes another Leaden Pipe as *EH*, of the ſame Diameter, riſing all the Way very gently from *E* to the Cock *H*, and ſo on to *I*; becauſe, if there was the leaſt Deſcent, Water wou'd lodge in it.

Now, when the Water runs from *A* to *B*, the firſt Ferril *D* will catch the Air as it runs, ſo as to let it out at *I*, if the Cock *H* be open, ſometimes without going to *G* or to *C*. But if the Cock had not been open'd, till the Water had paſs'd thro' the Part *AB* of the Pipe, the Air wou'd lodge in the Space *CC*, and be

diſcharg'd upon the opening of the Cock. After the Cock has been ſhut, when no more Air comes, and Water ſucceeds, after ſome time, Air will extricate it ſelf out of the Water and come up to *CC*; or if it comes from the Parts of the Pipe towards *B*, it will riſe contrary to the Current of the Water quite up to *C*, and ſo go out at the Pipe *EH*, when the Cock is open'd again.

As after the firſt Diſcharge of the Air, it cannot be known when more Air is got into the Pipe, unleſs by opening the Cock, which wou'd require one Man to attend each Cock conſtantly, and occaſion a waſte of Water at every turn of the Cock, unleſs when Air happens to be in the Pipe; it was propos'd to contrive a Valve that ſhou'd open to let out the Air, and ſhut again when the Water came; and an inverted Braſs Clack or Valve ſhutting upwards, and falling down by its own Weight, with Cork fix'd to the Under-ſide of it to help it to riſe when the Water came, was mention'd as fit for the Purpoſe by ſome of the Perſons that I was talking with about it. But we rejected that Propoſal; becauſe, when ſuch a Valve has been ſhut ſome time, if Air ſhou'd extricate itſelf from the Water, it wou'd be denſe Air, whoſe Force being equal to that of a Pillar of Water 30, 60, 80 or more Feet in height, it wou'd keep the Valve ſhut as well as the Water did before, tho' the Air at firſt cou'd not ſhut the ſaid Valve.

At laſt, after ſeveral Thoughts, we contriv'd a Machine which exactly anſwers the Purpoſe, and is very ſimple; therefore it will be of general Uſe.

The Deſcription of it is as follows.

In the fourth Figure *G* is a Section of the Main or Conduct Pipe, with Water up to *G*, and Air above it, *AB* being an horizontal Line touching the Top of the ſaid Pipe: *EHI* is the Leaden Pipe deſcrib'd above,

and

andmark'd with the ſame Letters as in the third Figure, reaching from the Pipe in the Street to the Side of an Houſe, or to the Side of one of the Poſts that are ſet up to keep off Coaches from the Foot-way. The Machine is the Box *K* made of Caſt-Iron, fix'd to the Leaden Pipe at *I*, with a thin Door of Plate-Iron, moving on Hinges, and made to lock at *D*. This Box ſtands in the Street out of the way of Paſſengers, with its Bottom fix'd to a Plank in the Pavement, ſo as not to be damag'd by a ſmall Shock or any chance Blow.

The ſeveral Parts of the Machine are the following.

Figure 5; *N N* is an Iron Plate about an Inch thick, with 4 Holes at 1, 2, 3, 4, of about an Inch Diameter, quite thro' the Plate, to let thro' 4 Screws, ſuch as *a*; O O is a Face, or flat Ring rais'd out of the whole Stuff, and prominent about $\frac{1}{4}$ of an Inch, ground, or turn'd to a true Flat. 5. Is an Hole of about $1\frac{1}{2}$ Inch Diameter, to receive the Noſe of a Cock, which is put thro' it, ſtopping with a Shoulder or Flaunch ſcrew'd within the Circle O O by 4 other Screws mark'd with large Points round the Hole 5.

Fig. 6 *N N* is the ſame Plate ſeen Edge-wiſe.

M is the Air-Cock ſcrew'd to the ſaid Plate thro' the Flaunch of its Pipe at *m n*, having its Key 6, 10, faſten'd to a Rod of about $\frac{1}{2}$ an Inch Diameter of the Figure 6, 7, 8, 10, having a Shank one Foot long, 8, 9 join'd to a Buoy or hollow Copper Ball *L*, which Ball, when the ſaid Shank is in an horizontal Situation, keeps the Cock ſhut; but falling by its own Weight, when not ſuſtain'd by the Water, opens the Cock by means of the Rod 8, 9, as may be ſeen in Figure 7, where the Plate *N N* is ſcrew'd to the Box, and the prick'd Line *M L* ſhews the Surface of the Water coming into the Box thro' the great Cock and Leaden Pipe *H I*, ſo as to make the Ball *L* float with its Shank

in

in the horizontal Situation 8, 9; but when more Air comes in to drive the Water down the Pipe *I*, the Buoy will fall to *l*, and its Shank coming down to 10, 11, will open the Air Cock *M*, and let out the Air (be its Denſity what it will) till it be all diſcharg'd, and the Water is again got up to *M L*, and has rais'd up the Buoy to *L*.

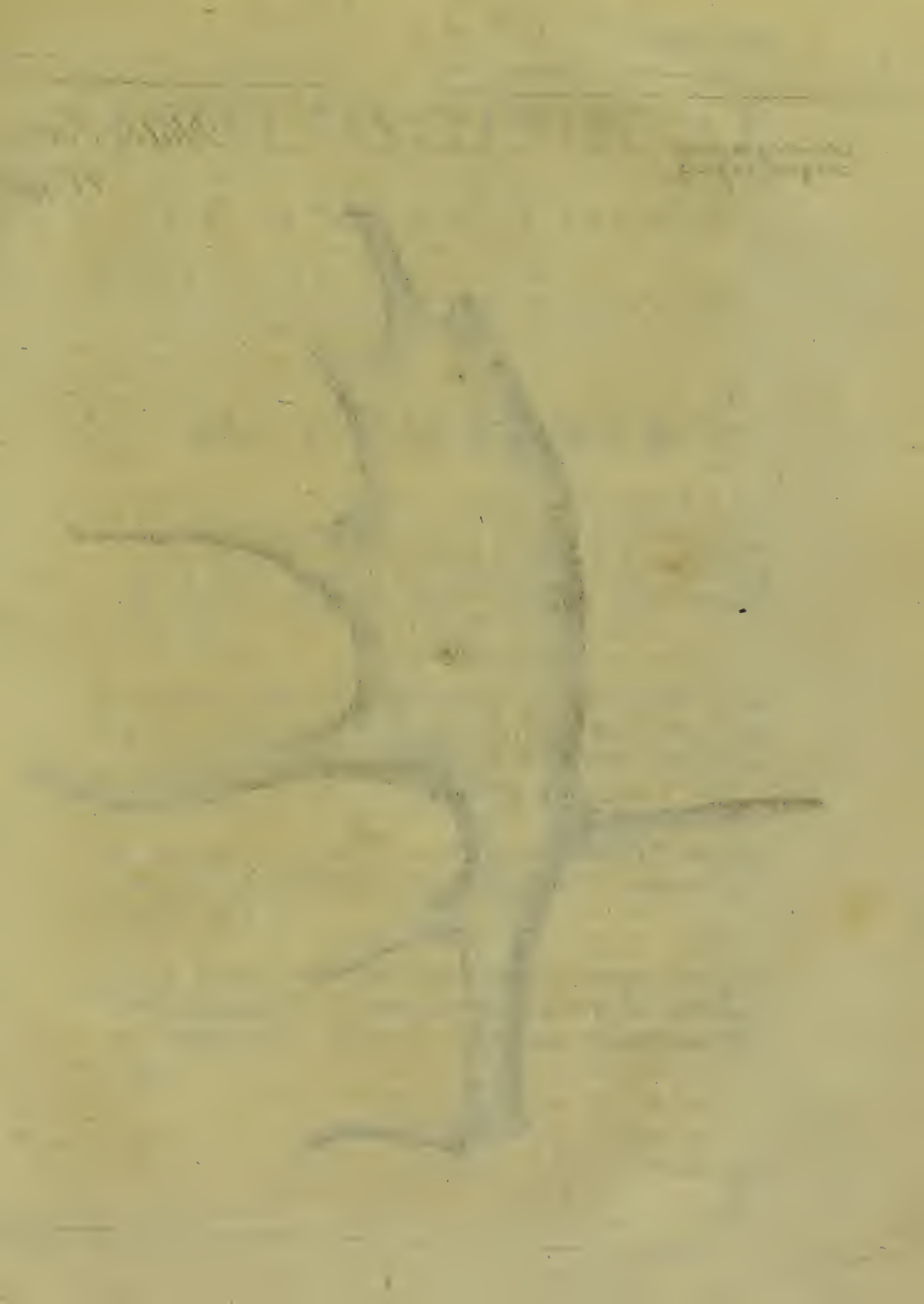
N N is the Fore-part of the Box with its Hole, to which the Plate of Fig. 5. is ſcrew'd.

It is eaſily conceiv'd, that the Cock *H* muſt always be left open; that the End of the Pipe *I* is ſcrew'd to an Hole in the Bottom of the Box by means of Screws at *r r*; that there are oil'd Leathers at the Heads of all the Screws, and likewiſe upon the Plate *N N*, to make the Face O O of Fig. 5. apply it ſelf cloſe to the Fore-part of the Box *K* (Fig. 8) which has an Hole at O O to take in the Buoy and Cock of Figure 6, the Screws at 1, 2, 3, 4, which have their Heads within the Box, and their Nuts ſuch as *b* (Fig. 5.) ſcrew'd on, when the Plate *N N* is apply'd; and that the whole Box, thus fitted is made Air-tight.

D in Figure 4. and *D D* in Fig. 7. repreſent an Iron Door, to cover the Mouth of the Air-Cock from external Injury, and is punch'd full of Holes to let out the Air freely.

This Machine, which from its Make, we call'd a *Jack in a Box*, will be uſeful wherever Water is to be convey'd a great way in Pipes; and ſince I was not the ſole Contriver of it, I ought in juſtice to thoſe that join'd their Thoughts with me, to acquaint the Publick, that the Box is the joint Invention of Mr. *Richard Jones*, Mr. *James King*, Mr. *Thomas Newcomen*, Mr. *Joſeph Hornblower*, his Operator, and my ſelf.

F I N I S.



A Scale of 12 Inches

3 6 9 12

Philos. Transact.

No. 394.

J. Parker Sculp.

Numb. 394.

PHILOSOPHICAL TRANSACTIONS

For the Months of *May*, *June*, and *July*, 1726.

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I. *The Longitude of* Lisbon, *and the Fort of* New York, *from* Wanſted *and* London, *determin'd by Eclipſes of the Firſt Satellite of* Jupiter. *By the Reverend Mr.* James Bradley, M. A. Aſtron. Prof. Savil. R. S. S.

SOME curious Aſtronomical Obſervations having lately been communicated to this Society from *Lisbon*, among which were ſeveral Eclipſes of the firſt Satellite of *Jupiter* * ; I was willing to examine whether I had made any at *Wanſted* which tallied with them, that by comparing ſuch together, the true Difference of Longitude between thoſe Places might be found. But looking over my Obſervations of the firſt Satellite, made laſt Year and the beginning of this, I meet only with Two Emerſions that were obſerved the ſame Night both at *Lisbon* and *Wanſted*. There are others, indeed, made within a few Days of each other, which may likewiſe be made uſe of to determine the Difference of Longitude ; but not with the ſame degree of Certainty, by reaſon of the irregular Motion of the Satellite ; which I preſume, chiefly ariſes from the Gravity of the other Satellites towards it. For altho' the Effect of the Influence that the Satellites have on each other, is moſt remarkable in the Second, whoſe Motion will ſometimes be accelerated or retarded thereby, as much as amounts to 30 or 40 Minutes in time, in the ſpace of about ſeven Months, or in half the Period in which the three innermoſt Satellites return, to have nearly the ſame Poſition with reſpect to themſelves, and the Shadow of *Jupiter* ; yet the firſt

* *Vide* Page 90.

ſeems alſo liable to Inequalities that cannot well be accounted for, but from ſome ſuch Cauſe as is before-mentioned, the effect of which will not eaſily be reduced to any Rule, but from a long and exact Series of Obſervations. And till ſome better and more certain Rule can be found out, we may ſuppoſe, that the Effect produced by this Cauſe, is, during ſmall Intervals, proportionable to the time. On this Suppoſition I have compared ſome Obſervations with others not made the ſame Nights; and the reſult is nearly the ſame as in thoſe which were obſerved at the ſame time in both Places, as will appear by the following Particulars.

The Immerſion of the Firſt Satellite was obſerved at *Wanſted* with Mr. *Hadley*'s Reflecting Teleſcope on *Auguſt* 4, N.S. 1725, about 45″ after the time of the Immerſion, as calculated from my Tables. By another Obſervation made *Auguſt* 29, N.S. the true Immerſion preceded the Calculation from the ſame Tables 1′ 10″. So that in 25 Days the Satellite's Motion was accelerated as much as anſwer'd to 1′ 55″ in time. Suppoſing therefore the Acceleration to have been in the ſame proportion between *July* 28, and *Auguſt* 4, N.S. then the true Immerſion *July* 28, N.S. would have happen'd at *Wanſted* about 1′ 15″ after the time by the Tables, which make the Immerſion at 12 h. 48′ 45″ App. Time. The true Immerſion therefore was at *Wanſted July* 28, N.S. 12h. 50′ 0″ App. Time; and at *Lisbon* 'twas obſerved at 12h. 12′ 26″ App. Time, the Difference being 37′ 34″.

September 28, N.S. the Firſt Satellite was ſeen emerging in the Reflecter at *Wanſted* 3′ 50″ ſooner than the Tables make the Emerſion; and by the Mean of two more Obſervations made at the ſame Place, and with the ſame Teleſcope, on the 14*th* and 16*th* of *October*, N.S. the true Emerſion preceded the Calculation

lation 4′ 30″. We may therefore from hence conclude, that on *Sept.* 21, N.S. the true Emerſion at *Wanſted* preceded the Calculation by the Tables about 3′ 35″, and that the true Emerſion there was at 12h. 1′ 15″ *Apr.* 1; but this Emerſion was obſerved at *Lisbon* at 11h. 24′ 55″, the Difference being 36′ 20″.

The Obſervations at *Wanſted* being made with Mr. *Hadley*'s Reflecting Teleſcope (by which one may ſee the Firſt Satellite near ¼ of a Minute ſooner when 'tis Emerging, than in a Refracting Teleſcope of 15 Feet, and the contrary when 'tis Immerging) there ought to be ſome Allowance made on account of different Teleſcopes made uſe of at *Lisbon* and *Wanſted*, by deducting 10 or 15″ from the Difference of Time collected from the Immerſions, and adding as much to the Difference deduced from the Emerſions. Such Correction being made, the Difference of Meridians by the Immerſion obſerved *July* 28, will be 37′ 20″, and by the Emerſion *Sept.* 21, 36′ 35″.

The Emerſion obſerved at *Lisbon*, *Decemb.* 8, N.S. at 8h. 32′ 40″ Apparent Time, was likewiſe ſeen at *Wanſted* in a 15 Foot Tube at 9h. 10′ 5″ Apparent Time, the Air being a little hazy, which may probably make the Difference 37′ 25″ a little too great.

The Emerſion ſeen at *Lisbon Jan.* 16, 1726, N. S. at 6h. 51′ 10″, which ſeems accompanied with Circumſtances that argue its Exactneſs, was likewiſe very well obſerved at *Wanſted* in a 15 Foot Tube at 7h. 28′ 22″ Apparent Time, the Difference being 37′ 12″.

Theſe are the only Obſervations among thoſe which were laſt communicated, that I could compare with any degree of Certainty with my own: But I find others printed in the *Philoſoph. Tranſact.* N°. 385, which were likewiſe made by the ſame curious Perſons, who obſerved an Emerſion of the Firſt Satellite at *Lisbon*

September 2, 1724, N.S. at 9h. 36′ 57″. This was ſeen alſo at *Wanſted* in the Reflecter at 10h. 13′ 28″ Apparent Time. Hence, allowing for the different Teleſcopes, the Difference of Meridians is 36′ 45″.

This Emerſion at *Wanſted* preceded the Calculation by the Tables 4′ 40″: And another Emerſion obſerved with the ſame Teleſcope on *Sept.* 18, N.S. preceded the Calculation 5′ 10″. We may therefore ſuppoſe, that on *Sept.* 9, N.S. the true Emerſion at *Wanſted* preceded the computed about 4′ 52″. The Emerſion that Day by the Tables was at 12h. 15′ 34″ App. Time; therefore the true Emerſion at *Wanſted* was at 12h. 10′ 42″. At *Lisbon* 'twas obſerved at 11h. 34′ 26″. So that allowing for the Difference of Teleſcopes, the Difference of Meridians by this Obſervation is 36′ 30″.

The Mean of all theſe Differences is about 36′ 58″, from which ſubſtracting 28″ for the Difference of Meridians between *London* and *Wanſted*, the remainder will be the Difference of Meridians between *London* and *Lisbon*, viz. 36′ ½ = 9° 7′ ½, *Lisbon* being ſo much to the Weſtward of *London*. This Difference of Longitude is about 5′ ½ greater than what is determined in the forementioned *Tranſaction*: But as the Gentlemen to whom we are indebted for theſe Obſervations, have given us hopes that they will continue to make and communicate more, we need not doubt but their exact Care and Diligence will ſoon enable us to judge yet more nicely of the true Situation of theſe Cities with reſpect to each other.

The ſame *Tranſaction* containing ſome Obſervations of Eclipſes of the ſame Satellite made in the Fort of *New York*, communicated by his Excellency *William Burnet*, Eſq; Governor of *New York*, I ſhall take this Oppor-

Opportunity of determining the Longitude of that Fort more exactly than it can be ſuppoſed to be there done, by the bare Compariſon of the Obſervations with the Tables; having two Obſervations made at *Wanſted*, which tally with two made at *New York*, on *Aug.* 25, and *Sept.* 10.

By the Obſervation made *Aug.* 25, 1723, O. S. which is eſteemed the moſt diſtinct and beſt, the Satellite Emerged at 9h. 35′ 14″ by the Clock, which went about 1′ ¾ too faſt for the Apparent Time at the Emerſion, as appears by the Altitudes of the Sun's Limb taken the Morning before and after the Obſervation; ſo that the Emerſion at *New York* was at 9h. 34′ Apparent Time; that is, 9h. 32′ 20″ Mean Time.

Auguſt 27, 8h. 57′ 40″ Mean Time, the Satellite was ſeen emerging at *Wanſted* in the Reflecter; and *Sept* 12, 7h. 17′ 15″ M. T. 'twas ſeen emerging again in the ſame Teleſcope: So that in 15d. 22h. 19′ 35″ there were 9 Emerſions; and the Interval between each was about 1 d. 18h. 28′ 50″. This ſubſtracted from the Time of the Emerſion obſerv'd at *Wanſted Auguſt* 27, will give the true Emerſion at *Wanſted* on *Auguſt* 25, 14h. 28′ 50″ M. T. that is, 4h. 56′ 30′′ later than it was obſerved at *New York.*

September 10, 8 h. 0′ 10″ by the Clock, another Emerſion was obſerved at *New York.* From the Altitudes of the Sun's Limb taken the Morning before, I compute the Error of the Clock at the time of the Emerſion to be 1′ 10″, and that the Emerſion happen'd at 7h. 59′ App. T. that is, 7h. 51′ 52″ Mean Time at *New York.* But ſubſtracting the forementioned Interval of 1 d. 18 h. 28′ 50″ from the Time of the Emerſion obſerved at *Wanſted September* 12, 7h. 17′ 15″ M. T. we ſhall have the time of the true Emerſion at *Wanſted* on *Sept.* 10, at 12h. 48′ 25″ M. T. which

which is 4h. 56′ 33″ later than 'twas obſerved at *New York*. The Difference therefore of Meridians between *Wanſted* and *New York*, allowing about 15″ for the Difference of Teleſcopes, is about 4h. 56′ 45″, and between *London* and *New York*, 4h. 56′ ¼. So that the true Longitude of *New York* from *London* is 74° 4′ Weſt.

II. *Obſervationes Aſtronomicæ habitæ* Ulyſſipone, *Anno* 1725, *& ſub init.* 1726, *à Rev. P.* Johanne Baptiſta Carbone, *Soc. Jeſ. Communicante* Iſaaco Sequeyra Samuda, *M.D. R.S.S. Coll. Med. Lond. Lic.*

Temp. Ver. correct. à Meridie.

RArò cælum hoc anno nubibus expers contemplari licuit. Tunc verò vel maximè turbatum ſenſimus, cùm aliquid ſpectatu dignum propiùs immineret; ut meritò crederem, omnes nobis hoc anno obſervationes Aſtronomicas fuiſſe interdictas. Perpaucas tandem habere datum eſt circa conſuetas intimi Jovis Satellitis Eclipſes, quas hìc ſubnecto, Lunari Eclipſi, die 21 Octobris, Martiſque tranſitu per Lunam, die 18 Septembris, omninò inobſervatis.

Mens.	*Dies.*		*H.*	*M.*	*S.*
Jul.	28.	Immergi viſus eſt in umbram Jovis veram,	12	12	26
		teleſcopio conſueto Joſephi Campani palmorum Rom. 30. Ceperat verò debilitari lumen,	12	11	35

Emerſit

Menſ.	*Dies.*		*H.*	*M.*	*S.*
Sept.	12.	Emerſit ab umbra vera Jovis, cælo ſatis ſereno; verùm ob Jovis cum Sole oppoſitionem, quæ ſeptem ante diebus contigerat, adeò Planetæ diſco proximus erat Satelles, ut ab ejus nimia claritate offuſcari aliquantulùm potuerit in primo ſui ab umbra egreſſu; ac proinde dubitari poteſt de aliquot ſecundis,	15	0	10
	14.	Cepit ab umbra emergere ——	9	28	7
		Integrum verò lumen recuperavit ——	9	29	0
	21.	Initium Emerſionis ab umbra vera -----	11	24	55
		totalis recuperatio luminis ——	11	26	0
Oct.	23.	Initium Emerſionis —— —— ——	8	11	10
		totalis recuperatio luminis —— ——	8	12	10
Nov.	8.	Viſus eſt Satelles clareſcere in penumbra; cum aliqua tamen incertitudine de vero initio emerſionis, ob aeris à vento trepidationem. Sed dubium fortaſſe quoad pauca tantùm ſecunda.	6	30	4
	15.	Diſtinctè obſervatum eſt initium Emerſionis. Recuperatio integra luminis —— ——	8	24	50
			8	25	50
Dec.	8.	Initium Emerſionis —— —— ——	8	32	40
		Totalis luminis recuperatio, —— ——	8	33	30

Anno 1726.

Menſ.	*Dies.*		*H.*	*M.*	*S.*
Jan.	9.	PRimò clareſcere viſus eſt, ſed luce tenuiſſima, ob aeris claritatem à crepuſculis, ac proinde non ſatis conſtat de vero initio emerſionis, ſaltem quoad ſecunda.	4	58	50
	16.	Satis clarè ac diſtinctè primò emergere viſus eſt, aere omninò pacato, ac ſereno ——	6	51	10
		totalis verò luminis recuperatio	6	52	15

Has tantùm circa primum Satellitem obſervationes habere nobis contigit ante Jovis cum Sole conjunctionem. Jam verò tempus adeſt, novas obſervandi Immerſiones; quas pro more noſtro tum diligenter obſervare, tum fideliter adnotare conabimur.

De Poli Elevatione Ulyſſipone.

QUÆ duo ad rem noſtram plurimùm facere arbitrati ſumus; quæque jam tum cùm ad hanc urbem primò appulimus, explorare contendimus, utpote ſupputationum omnium Aſtronomicarum præcipuum fundamentum, hujus, inquam, Clariſſimæ, atque Ampliſſimæ Urbis geographicam Longitudinem, ejuſque Latitudinem, ea ſanè quam-proximè nos eſſe aſſecutos exiſtimaverim. Primum, quod in ſpeciem difficiliùs videtur, circa finem primi anni à noſtro huc adventu, aſſequuti ſumus, comparatis nempe nonnullis obſervationibus,

nibus, quas hìc diligenter habueramus circa Eclipſes intimi Jovis ſatellitis cum habitis Romæ à Cl. V. Franciſco Blanchino. Deinde altero anno idem confirmavimus, tum novis ac repetitis obſervationibus circa eundem Satellitem, tum obſervationibus Eclipſis lunaris, quas contulimus cum habitis in Obſervatorio Regio Pariſienſi per Cl. V. Dominum Maraldum Regium Aſtronomum. Invenimus autem Ulyſſiponis Longitudinem, Grad. 8. Min 33 ; ſuppoſitâ tum Romanâ, tum Regii Obſervatorii Longitudine, pluribus anteactis experimentis, jam certâ. Obſervatorii ſiquidem Longitudo, ut Regiæ Academiæ monumenta perhibent, eſt Grad. 20. Min. 0. Differentia verò inter hunc Meridianum, ac Regii Obſervatorii, ut aliàs adnotavi, eſt Grad. 11. Min. 27, quibus occidentalior eſt Ulyſſipo; his igitur ſubtractis à Gradibus 20, remanet hujus Meridiani Longitudo ſupradicta Gr. 8. Min. 33.

Secundum verò, nempe hujuſce urbis Latitudinem, quam facilè quiſque aſſequi poſſe videtur, cùm innumeræ circa illam inſtitui poſſint interdiu, noctuque obſervationes, non adeò nobis opportunum fuit illam citiùs explorare ; inſtrumenta ſiquidem, quæ hìc invenimus, quæque etiam nobiſcum tulimus, etſi ſatis apta ad gradus ac minuta prima præter propter dignoſcenda, non tamen ad minuta eadem certiùs exploranda, multoque minùs ad ſecunda inveſtiganda (quæ ſanè Aſtronomis contemnenda non ſunt) opportuna eſſe videbantur. Atque hoc magìs, quod non una erat de hujuſce urbis Latitudine ſententia, quoad minuta prima ; quarum quidem nonnullæ propiùs veritati accedebant, ut ex noſtris quoque obſervationibus inferre licebat ; verùm nulli fidere certò poteramus. Duas tantùm ſententias in medium profero, quarum ſingulæ plurimùm ponderis apud prudentes habere poſſent ; ni diſcordia inter utramque earum fidem imminueret. Alte-

ra igitur ſententia eſt clariſſimi ac doctiſſimi viri Emanuelis Pimentel Regii Coſmographi, in mathematicis apprimè verſati, qui multis ac repetitis obſervationibus per umbram rectam Gnomonis, cujus altitudo pedum 16, ſe inveniſſe teſtatur hujus Poli altitudinem 38° 48′ 20″, quod in libello quodam MS. ejuſdem authoris legi, in quo & ipſas obſervationes ſusè adnotaverat. Altera verò ſententia eſt Regiæ Pariſienſis Academiæ ex obſervationibus domini Couplet, qui Ulyſſiponem venit Anno 1697, ubi aliquot inſtituit obſervationes ad Meridianorum differentiam Ulyſſiponenſis ſcilicet ac Regii Obſervatorii, necnon hujuſce urbis latitudinem inveniendam. Hanc autem ſe inveniſſe fatetur 38° 45′ 25″. Ut igitur certi aliquid in hac re deprehendere poſſemus, expectandum tantiſper exiſtimavimus, dum aptiora Pariſiis inſtrumenta reciperemus; ubi juſſu ac munificentia ſereniſſimi Regis noſtri tum multa alia conficiebantur à peritiſſimis artificibus inſtrumenta, tum in primis Quadrantes duo Aſtronomici, quorum alter quinque, alter trium pedum Pariſinorum, nec non Sextans totidem pedum. Hæc jam inde recepimus, & multiplici experimento ad trutinam revocavimus; nec ſanè quidquam ſenſibile in iis corrigendum invenimus, niſi quod facillimè corrigi poteſt, & plerumque obſervatorum curæ corrigendum relinquitur, dioptras nempe Teleſcopicas ad rectum ſitum reducere. Id facilè præſtitimus, ſtatimque prædictis inſtrumentis uti cepimus, ad prædictam Poli altitudinem inquirendam.

Plurimas ſanè inſtituimus obſervationes; quarum tamen aliquot hìc ſubnecto circa Solis altitudines, præſertim Meridianas, vel ſextante, vel quadrante Aſtronomico trium pedum habitas, poſtmodùm miſſurus alias tum prædictis, tum etiam quadrante murali quinque pedum habendas vel circa Solem, vel circa reliqua Aſtra. Juvat verò tum obſervatas altitudines Solis

ſub-

ſubnectere, tum integras etiam ſupputationes, unde Poli altitudo deducta eſt.

Obſervationes Altitudinum Solis Meridianarum ad Poli Elevationem inveſtigandam Ulyſſip.

SEquentium obſervationum aliæ habitæ ſunt in Collegio divi Antonii Magni, aliæ in Obſervatorio Palatii Regii ; quæ ſanè loca, cùm in eodem ſint Meridiano, quidquid inter ſe differunt, in ſola differunt Latitudine : At verò tanta non eſt differentia, ut ejus habenda ſit ratio in his obſervationibus, quibus hujuſce urbis Elevationem non adeò exactè exploratam volo, ut ſecunda quoque Graduum inventa affirmem. Diuturnioribus hæc opus habent experimentis; quippe ab innumeris pendent circunſtantiis, quæ non æquè ſemper concurrunt. Seriùs quidem id nos aſſecuturos arbitror.

Die 24. *Novembris* 1725.

	°	′	″
Altitudo Limbi ſuperioris Solis in Merid. quadrante Aſtronomico obſervata -----	30	56	20
Refractio propria hujus altitudinis ex tabulis Cl. V. Edmundi Halleii ———		1	28
Altitudo correcta ejuſdem Limbi ———	30	54	52
Parallaxis Solis ———			4
Altitudo vera Limbi ſuper Solem ———	30	54	56
Semidiameter Solis Appar. ——		16	18

	°	′	″
Altitudo vera centri Solis	30	38	38
Declinatio Solis Auſtral.	20	38	59
Altitudo Æquatoris	51	17	37
Complementum, ſeu Latitudo Ulyſſiponis	38	42	23

Die 5. Decembris.

Altitudo Meridiana Limbi ſuperioris Solis, ſextante obſervata	29	8	10
Refractio propria hujus altitudinis		1	35
Altitudo ejuſdem Limbi correcta	29	6	35
Parallaxis Solis			4
Altitudo vera Limbi ſuperioris Solis	29	6	39
Semidiameter Solis		16	20
Altitudo vera Centri Solis	28	50	19
Declinatio Solis Auſtralis	22	27	7
Altitudo Æquatoris	51	17	26
Complementum, ſeu Poli elevatio	38	42	34

Die 6. Decembris.

Altitudo Limbi ſuperioris Solis ſextante obſervata	29	1	0
Refractio propria hujus altitudinis		1	36
Altitudo correcta ejuſdem Limbi	28	59	24
Parallaxis Solis			4

Alti-

	°	′	″
Altitudo vera Limbi ſuperioris	28	59	28
Semidiameter Solis		16	21
Altitudo vera Centri Solis	28	43	7
Declinatio Solis Auſtralis	22	34	24
Altitudo Æquatoris	51	17	31
Complementum, ſeu Latitudo Ulyſſip.	38	42	29

Die 29. Decembris.

Altitudo Limbi ſuperioris Solis quadrante obſervata	28	20	22
Refractio propria hujus altitudinis		1	39
Altitudo correcta Limbi ſuperioris Solis	28	18	43
Parallaxis Solis			4
Altitudo vera Limbi ſuperioris Solis	28	18	47
Semidiameter Solis		16	21
Altitudo vera Centri Solis	28	2	26
Declinatio Auſtralis	23	14	57
Altitudo Æquatoris	51	17	23
Complementum, ſeu Latitudo Ulyſſip.	38	42	37

Die 8. *Januarii* 1726.

	°	′	″
Altitudo Limbi inferioris Solis ſextante obſervata	28	47	10
Refractio propria hujus altitudinis		1	37
Altitudo correcta Limbi inferioris Solis	28	45	33
Parallaxis Solis			4
Altitudo vera Limbi inferioris Solis	28	45	37
Semidiameter apparens Solis		16	21
Altitudo vera Centri Solis	29	1	58
Declinatio Auſtralis Solis	22	15	42
Altitudo Æquatoris	51	17	40
Complementum, ſeu Latitudo Ulyſſip.	38	42	20

Die 9. Januarii duas Solis altitudines ſextante Aſtronomico obſervavimus ante Meridiem, totidemque poſt Meridiem, alteras alteris reſpondentes, in verticalibus ſcilicet à Meridiano æquidiſtantibus; quod ut accuratiùs fieret, addita ſunt altitudinibus pomeridianis ſcrupula convenientia, quæ nimirum ex declinatione Solis, utcunque minori, refundi debebant in ipſam Solis verticalem altitudinem. Has quidem obſervationes eatenùs inſtituimus, ut noſtri horologii pendulo inſtructi vel minimam à tempore vero diſcordiam deprehenderemus, ſimulque meridianas lineas, quibus non unis utimur in hoc noſtro Collegio, iterùm atque iterùm ad trutinam revocaremus. Utræque verò obſervationes inter ſe collatæ, adeò

adeò exactè consensere in eadem differentia ostendenda, ut de illarum rectitudine non nisi temerè dubitarem. Opportunè igitur his ipsis observationibus usuros nos duxi ad Poli quoque altitudinem explorandam; his tribus nempe cognitis, altitudine Solis, ejusdem declinatione, & hora diei.

	°	′	″
Altitudo Solis vera ———	20	36	18
Ejusdem declinatio Australis —	22	8	11
Tempus verum observatæ altitudinis	9h.	37	26

Ex his igitur, per calculos Trigonometricos, quos inivimus (nec tamen hìc apponere opus est) resultat Poli elevatio Ulyssipone, 38° 42′ 24″.

Iterùm, ex secunda observatione matutina,

	°	′	″
Altitudo vera Solis ———	23	25	47
Ejusdem declinatio Australis ———	22	8	10
Tempus verum observatæ altitudinis	10h.	4	41

Ex quibus pariter per Trigonometriam resultat Poli elevatio Ulyssip. 38° 42′ 25″.

Ex observationibus pomeridianis, in quibus penè omnia sunt eadem atque in observationibus matutinis, eadem quoque inferri debebat altitudo Poli, ac proinde novis calculis non fuit opus.

Jam verò ex omnium observationum complexu, inferre hactenus licet Latitudinem Ulyssiponensem in hoc Collegio divi Antonii, aut etiam in Palatio Regio observatam non excedere 38° 43′, nec minorem esse 38° 42′; propiùs verò accedere ad 38° 42′ 30″. Quod fanè quamprimum novis atque iteratis observationibus certiùs innotescet.

Aliorum diſſidium in hac Elevatione aſſignanda, vel ex aliquo inſtrumentorum vitio (quod non facilè noſtris contingere potuit, cum & plura ſint, & grandiuſcula, nec uno ab artifice elaborata, ac tandem ſæpiùs adhibita in idem ſemper conſpiraverint) vel ex locorum diverſitate, in quibus obſervationes habitæ ſunt, oriri putaverim. Eſt enim Ulyſſipo ſatis ampla ; & à Borea ad Meridiem plus una extenditur Leuca, quæ quidem diſtantia trium, vel quatuor minutorum parere poſſet diſcordiam. Accedit ad hæc non exigua difficultas, quam quiſque, vel peritiſſimus, experiri ſolet in determinandâ extremitate umbræ veræ eâdemque à penumbrâ ſecernendâ; quam ſanè difficultatem non facilè declinaverit clariſſimus Vir, de quo ſuperiùs memini, Emanuel Pimentel, in ſuis obſervationibus per umbram rectam Gnomonis. Ac proinde nec mirum, ſi qua intercedat diverſitas, cùm non una ſit inſtrumentorum conditio. Sed hæc hactenus de Ulyſſiponis geographica latitudine.

Obſervationes Aſtronomicæ Telone Martio *habitæ à R. P.* Antonio Laval, *Soc.* JESU, *Hydrographo Regio, &* Ulyſſiponem *miſſæ P.* Joanni Baptiſtæ Carbone *ejuſdem Soc.*

Emerſiones intimi Satellitis Jovis.

1725.	H.	′	″			H.	′	″	
Sept. 23. Emerſio	6	56	42	T.V.	*Dec.* 17. Emerſio	5	56	34	
Oct. 16. Emerſio	7	15	17		*Dec.* 24. Emerſio	7	49	18	dub.
Nov. 8. Emerſio	7	31	33		1726.				
Nov. 15. Emerſio	9	26	52		*Jan.* 9. Emerſio	6	2	3	dub.

Die

Die 18, Januarii 1726, Martis *Occultatio à* Luna, *Temp. Ver. Hor.* 7. *Min.* 23, *Vespere.* Non satis certa.

Emersio Martis *H.* 8, *Min.* 21, *Scc.* 34, certa.

Altitudines Meridianæ apparentes Veneris.

1725.	Gr.	′	″
Mart. 20.	56	34	30
April. 21.	51	43	0
Maii 8.	59	35	0
Sept. 8.	44	30	30
21.	37	57	0
24.	36	26	30
Octob. 18.	26	28	45
Nov. 8.	21	50	0
Dec. 7.	23	59	30

	Gr.	′	″
Dec. 21.	28	21	0
Dec. 24.	29	30	0
1726.			
Jan 9.	36	29	0
19.	41	19	0
31.	47	14	0
Febr. 3.	48	40	30

Ex permultis accuratissimis observationibus *Telonis Martii* latitudo inventa est 43° 6′ 55″.

Die 20, Martii 1725.

	Gr.	′	″
Altitudo apparens Limbi superioris Solis quadrante Astronomico trium pedum Parisinorum observata *Telone Martio,*	47	6	10

Die 21, *ejusdem Mensis.*

Altitudo apparens ejusdem Limbi -----	47	30	10

Ex his observationibus inferri posset ingressus Solis in Æquinoctium Vernum. At non satis exactè, ut mihi videtur.

Differentia Meridianorum Ulyssiponem inter, ac Telonem Martium ex pluribus observationibus eruta est. 1 h. 0′ 9″; seu, Gr. 15 2′ 15″, quibus Ulyssipo occidentalior est Telone Martio.

III. *Singularia quædam in Cadavere calculoſo diſſecto reperta, ab* Abrahamo Vater, *M. D. Pr. Anat.* Wittemb. R.S.S.

JUvenis ſtudioſus per duos annos Dyſuria frequenti laborans, per illud tempus ultra quinquaginta calculos excrevit, quorum plerique ſine inſigni dolore inter mingendum ſeceſſerunt; quidam tamen eorum reliquis majores, piſorum majorum vel phaſeolorum magnitudinem habentes, in urethra ſubſtiterunt, ac manu chirurgi comminuti aut ſectione extracti fuerunt. Incidit hic ſenſim in Maraſmum totius corporis, ac urgente tuſſi ſicca & Aſthmate, accedente inſuper tumore pedum œdematoſo, tandem pridie ante mortem, lecto affixus, animam Creatori reddidit. Ad ſectionem corporis defuncti accedentes, aperto Thorace, pulmonem cum pericardio, diaphragmate & coſtis, hinc inde concretum, ac in dextro præprimis latere ſcirrhoſum invenimus, in utroque præterea ventriculo cordis, Polypos inſignes, qui truncos vaſorum occupaverant, & proculdubiò Aſthmatis atque inſequentis ſuffocationis, mortiſque ſubitaneæ præcipua cauſa fuerunt.

In abdomine hepar & lien nullo manifeſto vitio laborabant; inteſtinum autem ileon ſugillatum erat, & colon in toto ſuo ambitu, à dextro inde latere, ubi hepati accumbit, una cum recto, ita conſtrictum & contractum apparebat, ut vix digiti craſſitiem æquaret, nullamque ferè cavitatem interiùs monſtraret.

Tandem vias urinarias, utpote officinam tot calculorum viſitantes, in renibus atque ureteribus nihil præternaturalis invenimus, in veſica verò tres calculos, pha-

phaſeolorum magnitudinem habentes, eos tamen non liberos, ſed membrana valida involutos, ac lateri anteriori prope ſphincterem adhærentes deprehendimus, quos in rei memoriam una cum eorum involucro aſſervo. Unde hæc membrana, calculos involvens originem trahat, explicatu difficillimum mihi videtur; quamobrem hac data occaſione, flatu per ureterem utrumque immiſſo, inquiſivi, an illa (*viz* membrana) cum ureteribus communicet; & utrum ſit ipſa membrana Veſicæ interior, à calculis in ureteribus, inter ſubſtantiam Veſicæ incedentibus, una cum uretere, vel hoc rupto, extenſa: nihil tamen detegere potui. Hos tamen calculos Dyſuriæ non tantùm continuæ, ſed etiam propter irritationem perpetuam, conſtrictionis præternaturalis inteſtini coli atque recti extitiſſe, rationi conveniens videtur.

IV. *A Letter from Mr.* Colin Mac Laurin, *Profeſſor of Mathematicks at* Edinburgh, *and* F.R.S. *to* Martin Folkes, *Eſq*; V. *Pr. R.S. concerning Æquations with impoſſible Roots.*

SIR,

I Wrote to you laſt Winter, that I had thought of a very eaſie and ſimple way of demonſtrating Sir *Iſaac Newton's* Rule, by which it may be often diſcover'd when an Æquation has impoſſible Roots. This Method requiring nothing but the common Algebra, and being founded on ſome obvious Properties of Quantities demonſtrated in the following *Lemmata*, without having recourſe to the Conſideration of any Curve whatſoever, which does not ſeem ſo proper a Method in a Matter purely Algebraical, I hope it will not be unacceptable.

Lemma 1. The Sum of the Squares of two real Quantities is always greater than twice their Product. Thus a^2+b^2 is greater than $2ab$; becauſe the Exceſs a^2+b^2-2ab is equal to $\overline{a-b}^2$, and therefore is Poſitive; ſince the Square of any real Quantity, Negative or Poſitive, is always Poſitive.

Lemma 2. The Sum of the Squares of three real Quantities is always greater than the Sum of the Products that can be made by multiplying any two of them. Thus $a^2+b^2+c^2$ is always greater than $ab+ac+bc$; for 'tis plain, that the Exceſs $a^2+b^2+c^2-ab-ac-bc$

=

$= \frac{2a^2+2b^2+2c^2-2ab-2ac-2bc}{2} = \frac{a^2-2ab+b^2+a^2-2ac+c^2+b^2}{2}$

$-2bc+c^2 = \frac{\overline{a-b}^2+\overline{a-c}^2+\overline{b-c}^2}{2}$ that is, half the Sum of the Squares of the Differences of the Quantities a, b, c: But since these Squares are Positive, it follows, that the Excess of $a^2+b^2+c^2$ above $ab+ac+bc$ is Positive, and that the Sum of the Squares of three Quantities must be greater than the Sum of the Products made by multiplying any two of them.

Lemma 3. The triple Sum of the Squares of four Quantities is greater than the double Sum of the Products that can be made by multiplying any two of them; for $3a^2+3b^2+3c^2+3d^2-2ab-2ac-2ad-2bc-2bd-2cd = a^2-2ab+b^2+a^2-2ac+c^2+a^2-2ad+d^2+b^2-2bd+d^2+b^2-2bc+c^2+c^2-2cd+d^2 = \overline{a-d}^2+\overline{a-c}^2+\overline{a-d}^2+\overline{b-c}^2+\overline{b-d}^2+\overline{c-d}^2$, the Sum of the Squares of the Differences of the four Quantities a, b, c, d. Therefore $3a^2+3b^2+3c^2+3d^2$ is greater than $2ab+2ac+2ad+2bc+2bd+2cd$, the Excess being always Positive.

Lemma 4. Let the Number of the Quantities a b, c, d, e &c. be m the Sum of their Squares A, and the Sum of the Products made by multiplying any two of them B. Then shall $\frac{\overline{m-1}\times A}{2}$ be always greater than B.

For by adding together the Squares of the Differences $a-b$, $a-c$, $a-d$ $b-c$, $b-d$, $c-d$, &c. you add a^2 as often to it self as there are Quantities more than a; the same is true of b^2, c^2, d^2, e^2, &c. But the Rectangles $-2ab$, $-2ac$, $-2ad$, $-2bc$, $-2bd$, &c. arise but once each. Therefore the Sum of all the Squares $\overline{a-b}^2$, $\overline{a-c}^2$, $\overline{b-c}^2$, $\overline{b-d}^2$, &c. $= \overline{m-1}\times a^2+\overline{m-1}\times b^2+\overline{m-1}\times c^2$, &c. $-2ab-2ac-2bc$, &c. $= \overline{m-1}\times A-2B$. But $\overline{a-b}^2$

+

$+\overline{a-c}^2 + \overline{a-d}^2$, &c. is always a Positive Quantity; therefore $\overline{m-1} \times A - 2B$ is Positive, and consequently $\frac{\overline{m-1} \times A}{2}$ greater than B.

Cor. It appears from the Demonstration, that the Excess of $\overline{m-1} \times A$ above $2B$ is always equal to the Sum of the Squares of the Differences of the Quantities a, b, c, d, &c. and that when the Quantities a, b, c, d &c. are all equal, then $\overline{m-1} \times A - 2B = o$, and with this restriction on the preceding *Lemmata* must be understood.

It is to be observed, that tho' we have supposed in these *Lemmata* the Quantities a, b, c, d, &c. Positive, they are *a fortiori* true of Negative Quantities, whose Squares are the same as if they were Positive, while the Sum of their Products is either the same, or less than it would be, were they all Positive.

PROP. I.

In a Quadratic Æquation that has its Roots real, the Square of the second Term must be always greater than the quadruple Product of the third and first Terms.

Let the Roots of the Quadratic Æquation be represented by $+a$ and $+b$; and if x be the unknown Quantity, then shall $x^2 - ax + ab = o$
$-bx$

Now since $a^2 + b^2$ is greater than $2ab$, by *Lemma* 1, therefore $a^2 + b^2 + 2ab$ is greater than $4ab$; therefore $\overline{a+b}^2 \times x^2$, the Square of the second Term, will be greater than $4ab \times x^2$ the Quadruple Product of the first and third Terms.

PROP.

PROP. II.

In any Cubic Æquation, all whoſe Roots are real, the Square of the ſecond Term is always greater than the triple Product of the firſt and third.

If the Cubic Æquation has all its Roots real, they may be repreſented with their Signs by a, b, c, and the Æquation will be expreſſed thus:

$$\begin{aligned} y^3 - a y^2 + a b y - a b c &= o \\ - b y^2 + a c y & \\ - c y^2 + b c y & \end{aligned}$$

But by *Lemma* 2, $a^2+b^2+c^2$ is always greater than $a b+a c+b c$; and conſequently adding $2 a b+2 a c+2 b c$ to both ſides, $a^2+b^2+c^2+2 a b+2 a c+2 b c$ $(=\overline{a+b+c}^2)$ will be greater than $3 a b+3 a c+3 b c$; and therefore $\overline{a+b+c}^2 \times y^4$ muſt be greater than $\overline{3 a b+3 a c+3 b c} \times y^4$, that is, the Square of the ſecond Term muſt be greater than the triple Product of the firſt and third Terms.

Cor. 1. In general, it appears from the Demonſtration, that the Square of the Sum of three real Quantities, $\overline{a+b+c}^2$ is always greater than the triple Sum of all the Products, that can be made by multiplying any two of them into one another.

Cor. 2. It follows from the Propoſition, that when the Square of the ſecond Term is not greater than the triple Product of the firſt and third Terms, the Roots of the Æquation cannot be all real; but two of them muſt be impoſſible: And this plainly coincides with one Part of Sir *Iſaac Newton*'s Rule for diſcovering when the Roots of Cubic Æquations are impoſſible.

He

He desires you may write above the middle Terms of the Æquation the Fractions $\frac{1}{3}$, $\frac{1}{3}$ as in the Margin; and placing the Sign + under the first and last Term, he multiplies the Square of the second Term by the Fraction $\frac{1}{3}$ that is above it; and if the Product is greater than the Product of the adjacent Terms, he places + under the second Term; but if that Product is less, he places — under the second Term, and says, there are as many impossible Roots as changes in the Signs. Now by this Proposition, if $p^2 x^4$ is not greater than $3 q x^4$, or $\frac{1}{3} p^2 x^4$ greater than $q x^4$ the Roots cannot be all real. The same Supposition makes two Changes in the Signs, whatever Sign you place under the third Term, since the Signs under the first and last are both +; and therefore this Proposition demonstrates the first Part of Sir *Isaac Newton*'s Rule, as far as it relates to Cubic Æquations.

$$x^3 + \overset{\frac{1}{3}}{p} x^2 + \overset{\frac{1}{3}}{q} x + r = 0$$
$$+ \quad - \quad * \quad +$$

Cor. 3. If the second Term is wanting in a Cubic Æquation, and the third is Positive, two of the Roots of the Æquation must be impossible: for the Square of the second Term (equal to nothing in this Case) will be less than the triple Product of the adjacent Terms. But this will better appear from considering that, when the second Term vanishes in an Æquation, the Positive and Negative Roots are equal, and when added together, destroy each other. Suppose the Roots to be $+a$ and $-b$ $-c$; then in this Case $a = +b + c$, and the Coefficient of the third Term will be $-ab - ac + bc = -b^2 - 2bc - c^2 + bc = -b^2 - bc - c^2$, and consequently Negative. Or, if you suppose two Roots Positive and one Negative, let them be $-a + b + c$, then the Coefficient of the third Term will be still $-b^2 - bc - c^2$. Therefore when the Roots are real, the

the Coefficient of the third Term is negative; and if the Coefficient of the third Term is not affected with a negative Sign, it is a Proof that two of the Roots are Impoſſible.

PROP. III.

In any Cubic Æquation, all whoſe Roots are real, the Square of the third Term muſt be greater than the triple Product of the ſecond and fourth Terms.

In the ſame Cubic Æquation, whoſe Roots are a, b, c, the Square of the third Term is $\overline{ab+ac+bc}^2$, the Product of the ſecond and fourth Terms is $a^2bc+ab^2c+abc^2$, as is plain from the Inſpection of the Æquation; and it is obvious that $a^2bc+ab^2c+abc^2$ is the Sum of the Products of any two of the Terms ab, ac, bc; and therefore by *Corol.* 1 *Prop.* 2. the Square of the Sum of theſe Terms, that is, $\overline{ab+ac+bc}^2$ muſt be greater than $3a^2bc+3ab^2c+3ac^2b$. So that $\overline{ab+ac+bc}^2\times y^2$ muſt be greater than $\overline{3a^2bc+3ab^2c+3ac^2b}\times y^2$; that is, the Square of the third Term muſt be greater than the triple Product of the ſecond and fourth Terms.

Cor. 1. It follows from the Demonſtration, that $\overline{ab+ac+bc}^2$ is always greater than $3abc\times\overline{a+b+c}$.

Cor. 2. If the Square of the third Term is found to be leſs than the triple Product of the ſecond and fourth Terms, then the Roots of the Æquation cannot be all real Quantities; and this concludes with the ſecond Part of Sir *Iſaac Newton*'s Rule for finding when the Roots of a Cubic Æquation are impoſſible: For this Caſe gives — to be placed under the third Term, and

$$x^3+px^{\frac{1}{3}}+qx^{\frac{1}{3}}+r=0$$
$$+\quad *\quad -\quad +$$

conſequently two Changes of the Signs, whatever Sign is placed under the ſecond Term.

Schol. After the ſame manner, it may be demonſtrated, that in a Cubic Æquation, whoſe Roots are all real, if the ſecond Term is wanting, the Cube of the third Part of the third Term taken poſitively, is always greater than the Square of half the laſt Term. Suppoſe that the Roots of the Æquation are $+a, -b, -c$, or $-a, +b, +c$, and that $a = b + c$, then the ſecond Term in the Æquation will be wanting, and the other Terms will be expreſſed thus:

$$\begin{array}{l} y^3 * - b^2\, y \pm b\, c \times \overline{b + c} \\ - b\, c\, y \\ - c^2\, y \end{array}$$

The Square of $b - c$ is always poſitive, ſince b and c are real Quantities. Suppoſe it, (*viz.* $b^2 - 2\,bc + c^2$) equal to D, then $b^2 + bc + c^2 = D + 3\,bc$, and $\overline{b + c}^2 = D + 4\,bc$. Therefore $\frac{\overline{b^2 + bc + c^2}^3}{27} = \frac{D^3}{27} + \frac{D^2\,bc}{3} + Db^2 c^2 + b^3 c^3$, and $b^2 c^2 \times \frac{\overline{b + c}^2}{4} = \frac{D\,b^2 c^2}{4} + b^3 c^3$. Now 'tis obvious that $\frac{D^3}{27} + \frac{D^2\,bc}{3} + D\,b^2 c^2 + b^3 c^3$ is greater than $\frac{Db^2 c^2}{4} + b^3 c^3$, ſince D is poſitive, and $b\,c$ alſo poſitive, b and c being Roots having the ſame Sign. Therefore the Cube of $\frac{1}{3}$ of the third Term having its Sign changed $\left(= \frac{\overline{b^2 + bc + c^2}^3}{27}\right)$ is always greater than the Square of half the laſt Term $\left(= b^2 c^2 \times \frac{\overline{b + c}^2}{4}\right)$. In the Cubic Æquation $x^3 * + q\,x + r = o$, if q be poſitive, or if it

be

be negative and $\frac{+q^3}{27}$ be leſs than $\frac{1}{4} r^2$, it appears that two Roots of the Æquation muſt be impoſſible, from this Corollary, and from *Cor.* 3. *Prop.* 2. taken together.

PROP. IV.

In a Biquadratic Æquation, all whoſe Roots are real Quantities, $\frac{3}{8}$ of the Square of the ſecond Term is always greater than the Product of the firſt and third Terms; and $\frac{3}{8}$ of the Square of the fourth Term is always greater than the Product of the third and fifth Terms.

1. Let the Æquation be $x^4 - p x^4 + q x^2 - r x + s = o$; and ſince the Roots are ſuppoſed to be all real, let them be repreſented by a, b, c, d, then $p = a+b+c+d$, and $q = ab+ac+ad+bc+bd+cd$. But it is plain from *Lemma* 3, that $3a^2 + 3b^2 + 3c^2 + 3d^2$ is greater than $2ab + 2ac + 2ad + 2bc + 2bd + 2cd$; and conſequently by adding $6ab + 6ac + 6ad + 6bc + 6bd + 6cd$ to both, we ſhall find that $3 \times \overline{a+b+c+d}^2$ muſt be greater than $8ab + 8ac + 8ad + 8bc + 8bd + 8cd$; that is, $3p^2$ greater than $8q$; and therefore $\frac{3}{8} p^2 x^6$ greater than $q x^6$.

2. Since $r = abc + abd + acd + bcd$, and $s = abcd$; and ſince qs is equal to $a^2 b^2 cd + a^2 c^2 bd + a^2 d^2 bc + b^2 c^2 ad + b^2 d^2 ac + c^2 d^2 ab$, which are the Products can be made of any two of the Quantities abc, abd, acd, bcd, whoſe Sum is r multiplied by one another; it follows, that $3r^2$ is always greater than $8qs$: So that $\frac{3}{8}$ of either the Square of the ſecond Term, or of the Square of the fourth Term, muſt al-

ways be greater than the Product of the Terms adjacent to them.

Cor. Multiply either the Square of the ſecond Term, or the Square of the fourth Term of a Biquadratic Æquation by $\frac{1}{r}$, and if the Product does not exceed the Product of the adjacent Terms, ſome of the Roots of that Æquation muſt be impoſſible.

PROP. V.

In an Æquation of any Dimenſion expreſſed by m, the Coefficients of the ſecond, third, laſt, laſt but one, and laſt but two Terms, being reſpectively A, B, E, D, C, if the Roots of the Æquation are all real, then ſhall $\overline{m-1} \times A^2$ always be greater than $2mB$, and $\overline{m-1} \times D^2$ greater than $2mCE$.

1. For ſuppoſing the Roots to be a, b, c, d, e, &c. then by *Lemma* 4, ſhall $\overline{m-1} \times a^2 + \overline{m-1} \times b^2 + \overline{m-1} \times c^2$ &c. be greater than $2ab + 2ac + 2ad$, &c. and adding $\overline{2m-2} \times ab + \overline{2m-2} \times ac + \overline{2m-2} \times ad$, &c. to both, the Sum $\overline{m-1} \times a^2 + 2\overline{m-2} \times ab + \overline{m-1} \times b^2 + \&c.$ $(= \overline{m-1} \times \overline{a+b+c, \&c.}^2)$ muſt be greater than $2mab + 2mac + 2mad$, &c. that is, $\overline{m-1} \times A^2$ muſt be greater than $2mB$.

2. In general, it follows from this Demonſtration, that the Square of the Sum of any Quantities whoſe Number is (m) multiplied by $m-1$, muſt be greater than the Sum of all the Products can be made by multiplying any two of them, multiplied by $2m$. But it is eaſie to ſee from the Geneſis of Æquations, that CE is the Sum of the Products can be made by multiplying any two of the Terms whoſe Sum is D: From which it follows that $\overline{m-1} \times D^2$ muſt be always greater than $2mCE$.

To be continued.

V. *Observations upon the Dissection of an* Ostrich, *communicated in a Letter to the Publisher, by the Ingenious Mr.* George Warren, *Surgeon in* Cambridge.

SIR,

I Thought my self obliged to lay before you a few Observations I made in dissecting the Male-Ostrich which died at *Sturbridge*-Fair; tho' indeed, Dr *Brown* has so well describ'd the Parts of that which he dissected [*Philos. Collect.* N°. 5.] that I think, there is not much to be added. I presume, an Ostrich is allow'd now not only to be a Bird, but a Water-Fowl, and of the Goose-kind: For tho' I believe it does not swim, yet it has Legs long enough to go into deep Waters, and a Neck long enough to dip to the bottom of any Water where it can wade, and a Beak fitly made for the Prey of Fish, as that of a Goose is. Dr. *Brown* affirms it has no *Epiglottis*; but in this Subject that Cartilage was plainly visible; and indeed, the *Rimula* appeared too open not to require one. The *Os Hyoïdes* is three Inches long from the Basis; the *Musculi Directores Asperæ Arteriæ* were very plain, large and strong; the Ring composed of three Cartilages at the Divarication of the *Aspera Arteria* very bold; the two Glands on the Carotid Arteries, as large as small Eggs. There was nothing particular in the Lungs or Heart, but what it has in common with other Birds. The two Stomachs, *viz.* the Crop and Gizzard, were filled with half-digested Grass, in which were some Nails, some Stones of the bigness of Walnuts, and about fourteen or fifteen

fifteen Pieces of Silver and Copper-Money. The firſt Stomach, or Crop was exceedingly tender, and contain'd, cramm'd as it was, between three and four Quarts. The Glands on the top of the Crop were very large and numerous, in the Order deſcrib'd by Dr. *Brown*, and of the Bigneſs of little *Oculi Cancrorum*, and of a watery-brown Colour; which being ſo different from the Colour of the Stomach, that added to the pretty Order they are placed in, makes 'em very remarkable. The Crop lay within the *Thorax*, but ſo that the Gizzard lay higher. The Looſeneſs and Likeneſs to Flannel, of the inner Coat of the Gizzard, mentioned by Dr. *Brown*, was very remarkable in this Bird; but the Texture in the Muſcular Part of it did not ſeem proportionably ſtrong to that in other Birds, being broader, thinner, and more flaccid. The Guts, as near as I could meaſure them, were about twenty ſix Yards long. The two *Cæcums*, which are about thirty four Inches long each, and which have beautiful ſpiral Valves, were Appendages of the very Beginning of the *Colon*. The Teſticles lay as in other Fowls, very high, and leſs than Pidgeons Eggs, but longer. I found the Liver to have four Lobes, and thought I had met with a Gall-Bladder, but it appear'd at laſt to be only the Membrane of the Liver rais'd by ſome Accident from its inner Subſtance. The Gland under the Stomach, which Dr. *Brown* ſuppoſes to be the Spleen, and the *Pancreas* and Kidneys anſwer his Deſcription; and the Ureters were, as he ſays, firm, ſtrong, white, long, and opening into the *Rectum*. The Eye is ſaid to be exactly like the Human Eye; but is indeed, a perfect Gooſe-Eye for its Colour, and, I believe, for the reſt of its Parts, as they are well deſcribed by Mr. *Ranby*: It was flatter than the Human Eye, as, I believe, all Birds are; and it had that ſimple Look ſo peculiar to the Gooſe.

Gooſe. The Bony Circle deſcrib'd by Mr. *Ranby*, this Bird has in common with other Fowls both of the Water and Land, with this difference only, that the Ring in Water-Fowls conſiſts of fifteen, and in Land-Fowls but of fourteen Bones. They are ſo diſpos'd, that one Bone lies over the Ends of two others, then three or four lie over one another, like the Scales of Fiſh; then one Bone lies under the Ends of two others; and then two or three more follow again like the Scales of Fiſh: But unleſs there be a *Luſus Naturæ*, I think Mr. *Ranby*'s *Icon* does not expreſs it ſo very juſtly, as I believe it might be done. There was no *Muſculus ſuſpenſorius Oculi* in this Animal, nor do I believe it is to be found among Birds, and indeed there ſeems to be no reaſon for it

The Crop was ſo ſtuff'd with Graſs, or other Greens (proper Food for a Gooſe, or one of that Kind) that I don't think the Bird could have digeſted it off, if there had been no other reaſon for its Death. The Gizzard was not ſo ſtuff'd as the Crop, and what was therein, ſeem'd undigeſted. The Guts contain'd a thick deep-green Juice, even to the *Cloaca*. The Money both of Silver and Copper in the Gizzard was very remarkably worn away; the Edges, in particular, were made round, and the Buſt and Reverſe ſcarce perceptible in ſome Pieces, and quite obliterated in others. The *Ærugo* and *Sulci* in many of the Pieces would make one believe (that beſides the Attrition) there may be a *Menſtruum* in their Gizzards not unfit to diſſolve Metals Within an Inch of the End of the *Rectum* was the *Cloaca*, or Expanſion of that great Gut, which was thinner than the other Part of the Gut, in proportion to its Expanſion, and would hold above half a Pint. The End of the *Rectum* (from the *Cloaca*) open'd into a Cavity big enough to hold my two Fiſts; and for want of another

other Name, I will call it the *Receptaculum Penis*, becauſe therein the *Penis* was always lodged when flaccid. I know, that Part is called by Dr. *Brown*, *a kind of Præpuce*; but upon Diſſection, it appeared plain enough to me to be a very ſtrong Muſcle compos'd of circular Fibres, and to be deſigned for a Sphincter of that Part wherein the *Penis* was to be lodg'd, and to be a Sphincter of the *Rectum* too; round which I traced the ſame Muſcle above an Inch; and this being but one Muſcle, muſt be the reaſon that the *Penis* always came out ſome Inches when it muted, as they told me it did. The *Penis*, flaccid as it is, is five Inches and an half long from the Skin of that *Receptaculum*, and, as Dr. *Harvey* ſays, not unlike an Hart's Tongue. I don't find a Cartilage in it, as Dr. *Brown* ſuggeſts; but at its Origination it is ſo hard a Body, that, I believe, if the Bird had liv'd ſome Years, it poſſibly might have become Cartilaginous. There are two Bodies that are join'd to the *Crura Penis*, which I ſuſpect to be the *Veſiculæ ſeminales*; and the more, becauſe there are two Veſſels enter them, which I believe to be the *Vaſa Deferentia*; but of this I am not certain: For tho' I found *Semen* in the *Urethra*, I have not been able to trace a Paſſage from theſe ſuppoſed *Veſiculæ ſeminales*, or thoſe Veſſels, or any other Part into the *Urethra*. I call it *Urethra*, becauſe there is no other Term fix'd that I know of, tho' the Urine does not paſs that way; but, as in other Birds, is mix'd with the groſſer Excrements in the *Cloaca*. The *Urethra* then, is only a *Sulcus*, or Gutter, from one end of the *Penis* to the other; which *Sulcus*, as the *Penis* lies flaccid in the *Receptaculum*, as I venture to call it, lies on one ſide; but upon Erection, the *Penis* turns towards the Belly, and the *Sulcus* is then at the Top, and lies conveniently enough for Conveyance of the *Semen*. If thoſe two Bodies are not the *Veſiculæ ſeminales* (as I mention'd before) they muſt

muſt be Elongations of the *Crura Penis*; but I think, they are of much too looſe a Contexture to ſerve that purpoſe. Whether the *Vena Cava*, dividing into two Branches to go into the Kidneys, and uniting again when it comes out, is ſingular to this Bird, or is in common with Geeſe and other Water-Fowl, I don't yet know; but ſo it was in the Oſtrich. I will ſuppoſe it to be in common, till I have examin'd further, ſince I know, that the *Cæcums* of the Oſtrich, which are ſo much taken notice of, are no more than what it has in common with other Fowls; and that a Chicken has two, as large, and as long in proportion as the Oſtrich: But after all, I muſt ſay, I had too little time allow'd me by the Maſter of the Oſtrich, and the Oſtrich had too much Fat for me to make a more accurate Diſſection. Now I have mentioned the Fat, I muſt tell you, the *Omentum* upon the Stomachs and Guts was ſix Inches thick at the Top, and decreaſing gradually, was near two Inches thick at the Vent, and was divided into two Parts in the Middle from the Top to the Bottom. What I found, that I was ſure was in common with other Fowls, I have not taken much notice of, unleſs repreſented by others differently from what I found, or ſo as if peculiar to this Bird. I forgot to take notice, that the Baſis of the *Os Hyoïdes* is of this Figure and the round Part at the Top is lodg'd in a proper Cavity in the top of the Tongue. Partly under the Baſis of the *Os Hyoïdes*, lies a Cartilage in the Front and very beginning of the *Aſpera Arteria*, which is not unlike the *Thyroïdes*; but other Cartilages in that Part it has none, but what forms the *Rimula*. The firſt 28 Cartilages of the *Aſpera Arteria* are not annular, the reſt (being about 226) are entirely annular; but as ſoon as it divaricates to go into the Lungs, they are not ſo again.

Cambridge, Oct. 17, 1725. *I am*, &c. G. WARREN.

VI. *An Account of a Perſon kill'd by Lightning at* Worceſter, *communicated in a Letter to the Publiſher, by* R. Beard, M. D. R. S. S.

The following Account was given to a Gentleman at the time the Affair happened; but not knowing whether it deſerv'd your Conſideration, I deferr'd ſending it till you were pleas'd to deſire it.

Worceſter, June 11, 1724.

WE had laſt Night continu'd Lightning in the Eaſt from Eight o' clock to Twelve; the Weather for ſome time before having been very ſultry, the Wind at N. E. and the Barometer at ſettled Fair. This Morning the Mercury ſunk, and the Sky became more Cloudy and Temperate, except a few hot Gleams; at Two in the Afternoon, ſeveral fierce Showers fell, attended with Flaſhes of Lightning and Claps of Thunder, that ſtill approach'd nearer us: Between Two and Three, a Flaſh came ſo violently upon me, ſucceeded ſo very quick by a low, unuſual, dreadful Sound, that I immediately went to the door, fearing ſome Miſchief near. I was ſoon call'd to an Officer's Lady (aged about 18, and breeding) kill'd by it in the adjoyning Street. I found her yet warm, and that ſhe had ſurvived the Stroke for 6 or 7 Minutes. The Fire-Marks they ſhew'd me, were Streaks of a Copper-Colour branched from the Left Shoulder all-over the *Thorax*, and interſperſed here and there with irregular Spots, which gave occaſion for that Conceit publiſh'd in our News, that

that *curious Plants were drawn on her Boſom, as with the fineſt Pencil.* This ſad Accident happen'd in a Parlour-Window next the Street, that could contain about two Perſons: The Lady, it ſeems, terrified with the repeated Lightning and Thunder, (it having formerly been fatal to her Brother) deſir'd an Officer to change Places with her, that ſhe might be near her Husband; but ſhe was no ſooner ſeated by his ſide, than ſhe inclined ſide-ways, and ſpoke ſome Words; after ſhe was carried to another Room, ſhe ſaid, ſhe was gone, and then, that ſhe was blind, and ask'd for Water. The Husband was thrown along, together with the fortunate Gentleman that had juſt reſign'd his Seat; and a large Looking-Glaſs was lifted off the Hooks. The Landlord's Daughter, at work near the Lady, perceiv'd ſuch an Impulſe on the ſide of her Head, that her Hearing was much impair'd, *and upon every Peal of Thunder ſince, ſhe is affected in like manner, tho' not ſo ſtrongly.* The Gentlemen complained, that they were ſtupified, forced down they did not know why, unleſs it were for want of Breath; and of Pains and Numbneſs in their Limbs. They had likewiſe on different Parts of their Bodies ſuch reddiſh Wheals as were ſeen on the Fair Lady's Breaſt: But theſe Symptoms vaniſhed the next Day. The other two Perſons at the further End of the Room were untouch'd; they were all ſenſible of a ſulphurous Smell. The Pane of Glaſs exactly behind the Lady's Waſt, was perforated by a round Hole of an Inch and half Diameter, as if done with a Diamond, or rather a Wind-Gun; but no where thereabouts could I diſcern the leaſt Traces of Fire, or Heat, nor on the Lady's Clothes (having no Stayes on) the Signs of any Violence. On a more nice Examination of the Body, in the Preſence of the Friends, that Evening, I diſcovered on the left Loin, taking in

part of the Spine of the *Os Ilium*, which was ſomewhat ſwoln, a deep Contuſion of the ſame Dimenſion with the Breach in the Glaſs: The Skin was neither indurated, nor pierc'd: The Blood in the Capillaries all round, but chiefly up the Back, ſettled, the Colour of which was eaſily diſtinguiſhed from that of the Streaks, and the circular Impreſſion.

The *Phænomenon*, that cauſed this Misfortune, roſe from the N.E. firſt ſlid off the Gabel-Beam, and the Bricks on the back part of the next Houſe, fill'd a little Court with Flame and Smoke, then turned a Leaden Spout contrary to its former Direction, mounted over the Roof, and, cracking a Stack of Chimneys, dropt down at the Window where the Husband and Wife ſate. Some credible People that ſaw it, to their great Terrour, aſſure me, that it was a Ball of Fire, and that it burſt with the loudeſt Report they ever heard, and then with a hiſſing Noiſe, paſs'd about a Yard from the Ground through an adjacent Street, and rowl'd off to to the S.W. Some Workmen there, and on a neighbouring Hill, obſerved the ſame.

In my Opinion, the Mortality of this Blow may be accounted for from the known Effects of impriſon'd Air only, when ſet at liberty, as the Appearances on the Skin may, from other active Particles hurried along with it at the time of the Exploſion. The *Impetus* being firſt received on the Parts deſcrib'd, occaſioned her Death to be leſs ſudden than uſual in ſuch Caſes.

Worceſter, June 4, 1726.

We have had more Lightning and Thunder the Week paſt, than ever has been known in that ſpace of time: And what was more extraordinary, the Continuance of it for 9 or 10 Hours together, with little or no Intermiſſion, and at ſuch a height above us. So far has this been

been from doing any great Damage near us, that in the Opinion of the Country-Farmers, it had very good Effects, eſpecially at the beginning during the Heat: For the little Inſects, that in ſome Places threaten'd the Deſtruction of the Hops and ſome other Plants, fell off like Bees by the Steam of a lighted Match. I know not whether this has been obſerv'd to you before; but I ſaw ſuch remarkable Inſtances of it in certain Situations, that I could not help giving you this ſhort Account of it.

I am, &c.

R. Beard.

VII. *An Account of the* Strata *met with in digging for Marle, and of* Horns *found under Ground in* Ireland ; *in a Letter from Mr.* James Kelly *to the Right Honourable* Edward Southwell, *Esq*;

Downpatrick, *Dec.* 22, 1725.

Honour'd Sir,

SINCE I know you to be a Gentleman very curious in searching after Nature, I thought it would not be unacceptable, to give you an account of these Appearances, that we meet with in searching for Marle, now in so plentiful a manner found on your Estate in this Country.

Our Marle is found no where but in the Bottoms of low Boggs, where we search for it with Augres, and find it at the depth of seven, eight, or nine Foot: This in many Places occasions great Expence in draining off the Water. When we think to dig for it, we chuse out six able Labourers and a Supernumerary; then we cut up a Hole twelve Foot square; because we judge that this Number of Men will manage that Pit in one Day, *viz.* two Men to dig, two Men to throw it up, and two Men to throw it by. The Supernumerary supplies Defects in every part, as will be found necessary. For the first three Foot, we meet with a fuzzy sort of Earth, that we call *Moss*, proper to make Turf for Fuel; then we find a *Stratum* of Gravel about half a Foot; under which, for about three Foot more, we find a more kindly Moss, that would make a more excellent Fuel: This is altogether mixt with Timber, but so rotten, that the Spade cuts it as easily as it doth the Earth: Under this, for

for the depth of three Inches, we find Leaves, for the moſt part Oaken, that appear fair to the Eye, but will not bear a Touch. This *Stratum* we find ſometimes interrupted with Heaps of Seed, that ſeem to be Broom or Furze-Seed: Nay, in one Place I ſaw, what appeared to me to be Gooſeberries and Currants: In other Places in the ſame *Stratum* we find Sea-weed, and other things as odd to be at that depth: Under this appears a *Stratum* of blue Clay, of half a Foot thick, fully mixt with Shells; this we look upon to be good Marle, and throw it up as ſuch: Then appears the right Marle, commonly 2, 3, or 4 Foot deep, and in ſome Places much deeper, which looks like buried Lime, or the Lime that Tanners throw out of their Lime-Pits, only that it is full-mixt with Shells: Theſe are ſmall Perriwinkles, ſuch as the *Scots* call *Freſh Water-Wilks*; tho' there are among them abundance of round red Perriwinkles, ſuch as I have often ſeen thrown out on the Sea-Shore. Among this Marle, and often at the bottom of it, we find very great Horns, which we, for want of another Name, call *Elk-Horns*: Where they joyn the Head, they are thick and round; and at that Joyning there grows out a Branch of about a Foot long, that ſeems to have hung juſt over the Beaſt's Eyes: It grows round above this for about a Foot and ſome odds; then ſpreads broad, which ends in Branches, long and round, turning with a ſmall Bend. The Labourers are commonly ſo buſie, that they rarely bring them up whole; yet I have one pretty well, of which I ſend you an *Icon*, *V. Fig.* done as well as I could, but not ſo nice as I could wiſh. We have alſo found Shanks and other Bones of theſe Beaſts in the ſame Place.

I am, *&c.*

James Kelly.

F I N I S.

Philos. Trans. N.º 395

Fig 1

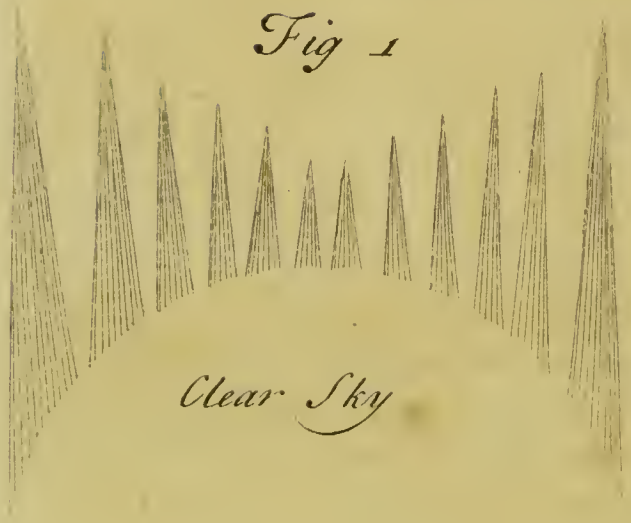
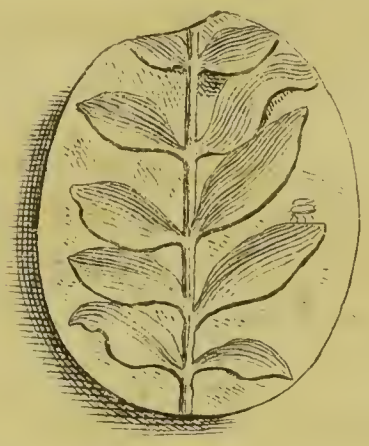


Fig. 2



Numb. 395.

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151 ALchimilla vulgaris, C.B. 319.
152 — Alpina, pubeſcens, minor, H. Reg. Par.
153 Aſter Americanus Belvidere foliis, floribus ex cœruleo albicantibus, ſpicis prælongis. Pluk. Phyt. Tab. 78. f. 5.
154 — Virginianus, anguſtifolius, ſerotinus, parvo albente flore, Park. Th. 132.
155 — —, pyramidatus, Hyſſopi foliis, aſperis, calycis ſquamulis foliaceis.
156 — maritimus flavus, Crithmum chryſanthemum dictus, Raii Hiſt. 268.
157 Brunella Caroliniana, magno flore, dilutè cœruleo; internodiis prælongis.
158 — Novæ Angliæ, major; foliis longiùs mucronatis.
159 Caucalis Hiſpanica, Cam. Hort. 37. Fig. XI.
160 Corchorus Americana, prælongis foliis, capſula ſtriata, ſubrotunda, brevi, Pluk. Phyt. Tab 255. f. 4.
161 Corona Solis Caroliniana, parvis floribus, folio trinervi amplo, aſpero, pediculo alato.
162 — — Rapunculi radice, T. Inſt. 490.
163 Dictamnus Creticus, C.B. 222.
164 Dorycnium Monſpelienſium, Lob. Icon. 2. 51.

165 Elichryſum ſylveſtre, latifolium, capitulis conglobatis, C.B. 264.
166 Eupatorium Senecionis facie, folio Lamii, Par. Bat. Ic. 161.
167 Fænum Græcum, quod Melilotus corniculis reflexis major, C.B. 331.
168 Fumaria minor, tenuifolia, cauliculis procumbentibus & caducis, C.B. 143.
169 Geniſta Hiſpanica humilis, floribus congeſtis villoſis. Sparto primo affinis, C.B. 396.
170 Geranium Cicutæ folio, erectum, Romanum, Bocc. Muſ. p. 2, 93.
171 — Columbinum erectum, Carolinianum, floribus purpuraſcentibus.
172 Hermannia fruteſcens, foliis oblongis, ad apices ſolummodò ſerratis.
173 Jacobæa Africana, fruteſcens, flore amplo purpureo elegantiſſimo, Senecionis folio, Volk. Flor. Norimb.
174 Jacobæa Sicula, Chryſanthemi facie, Bocc. rar. p. 66.
175 Lychnidea Virginiana, Holoſtei ampliore folio, floribus umbellatis, purpureis.
176 Marrubium album, foliis amplis, ferè circinatis.
177 Myoſotis Hiſpanica ſegetum, T. Inſt. 245.
178 — Orientalis perfoliata, Lychnidis folio, T. Cor. 18.
179 Pentaphylloides erectum, J.B. 2. 398.
180 — Canadenſe, folio Agrimoniæ. Sarracen. D. Vaillant.
181 — Fragariæ folio, Bot. Monſp. App. 309.
182 — — — & crenis obtuſioribus.
183 Quinquefolium rectum luteum, C.B. 325.
184 — quod Pentaphyllum, ſeu potiùs Heptaphyllum rectum, caule rubro, hirſutius, H. Cath. Boerh. Ind. 2 40.

185 — minus, flore pallidè luteo, T. Inſt. 297.
186 — ſolio argenteo, C. B. 325.
187 Phlomis fruticoſa, humilis, latifolia, candidiſſima; floribus luteis.
188 — Orientalis, lutea, herbacea, latifolia, verticillata.
189 Sclarea rugoſo, verrucoſo & laciniato folio, T. Inſt. 180.
190 Senecio Ægyptius, folio Matricariæ, Boerh. Ind. 1. p. 40.
191 Sideritis arvenſis, latifolia, glabra, C.B. 233.
192 — Vulgaris hirſuta erecta, C.B. Ib.
193 Serratula annua, ſeminibus nitidiſſimis ad baſin compreſſis. Senecio carduus Apulus, Col. p. 1, 32.
194 — —, — —, majoribus & minimè compreſſis, Crupina Belgarum vulgò.
195 Teucrium Bæticum, Cluſ. Hiſp. 229.
196 — —, humilius & ramoſius, folio ſubrotundo.
197 Thlaſpi arvenſe, Vaccariæ incano folio, majus, C.B. 206.
198 —, Vaccariæ incano folio, minus, C.B. Ib.
199 Virga aurea, Canadenſis, Aſteriſci folio, Par. Bat. 244.
200 — —, montana, Scrophulariæ folio, Icon. Robert. Pluk. Phyt. Tab. 235. f. 3.

II. *An Account of an* Aurora Borealis *ſeen in* Ireland *in* September 1725 ; *in a Letter from* Arthur Dobbs, *Eſq*; *to his Brother the Reverend Mr.* Richard Dobbs, *Fellow of* Trinity-College, Dublin.

Caſtle Dobbs, Sept. 29, 1725.

I Here ſend you an Account of an *Aurora Borealis*, which I ſaw here the 24*th*, 25*th*, and 26*th* Inſtant, with Reflections upon it; which, if compar'd with others, or the ſame view'd at other Places, may in ſome meaſure contribute to clear up the nature of it.

I obſerv'd, that the Theatre of Light forming an irregular variable Curve, was, as at moſt times formerly, from E. N. E. to W. N. W. the Horizon and whole Hemiſphere ſerene, little or no Wind, what there was, ſeem'd Northerly. The ſeeming Dawn, or Stage of Light generally continu'd in an irregular Curve ; the one Point in the two firſt Nights whilſt I obſerv'd it, began near the Horizon, near N.N.E. the other Point was at W.N.W. the Height of the Arch not exceeding 20 Degrees, in which there ſeem'd to be a continual Dawn : Under that Field of Light ſeem'd to be a dark Cloud, which, however, was a clear Sky, not filled with that luminous Vapour ; becauſe all the Stars appear'd diſtinctly and twinkling thro' it. Whenever that Light roſe about 10 Degrees higher, to about 30 Degrees, then Flaſhes, or Coruſcations follow'd alternately, and ſeemed to be Pillars or Beams of Light, which follow'd or ſucceeded one another, and by that means

means ſeem'd to move and change with one another, by the Succeſſion of Light and Darkneſs, according to the Flaſhes. When the lighted Vapour roſe higher to about 40 or 45 Degrees, then the Appearance alter'd; and inſtead of Beams, or Pillars of Light, as when lower, there were Flaſhes like thoſe attending Exploſions, wherein faint Colours of Red, Green and Yellow appeared, but not very vivid; and upon each Exploſion it would ſpread upwards towards the Zenith, in the Appearance of thin enlighten'd Clouds, and immediately diſappear. On the 26*th*, about 9 at Night, one of theſe irregular Arches of Light had got up to the Zenith, the lower Points being near E. N. E and W. S. W. I then ſaw it for a conſiderable time, at leaſt a quarter of an hour, and it had been there for ſome time before I ſaw it. I could diſtinctly obſerve all the different Appearances, according to its Altitude in the Hemiſphere, *viz* the lower part (being within 12 or 14 Degrees, as near as I could compute) was a conſtant fixed Light, equal to the Light of the Edge of a white Cloud in the Day-time, when the Sun ſhines on it. As it roſe higher, I could obſerve it ſomewhat weaker, and could perceive the Motion of the Pillars or Beams of Light after each Flaſh, which ſeemed by that means to move. Somewhat higher again, at about 40 Degrees, the Flaſhes were like Exploſions of great Guns, with the faint Colours obſerved as before; but the Coruſcations or Flaſhes from thence to the Zenith, expanded at every Flaſh, like a broad, thin, white Cloud, of which ſome faint View could be ſeen after each Exploſion for ſome time: And after all the Exploſions were over, there remain'd a thin duskiſh Vapour in and near the Zenith, and all along the Arch from Eaſt to Weſt, from 14 to 20 Degrees broad, which undulated and mov'd like a ſtormy Sea, the Motion coming from

from the S.S.E. and ſo leſſen'd till it appear'd no brighter than the Milky Way, but more like a very thin Cloud or Miſt, thro' which I could perceive the Stars. At the ſame time I ſaw another thin Cloud, having the ſame Appearance, Arch-ways, to the Southward, at about the Height of 40 Degrees, which I ſuppoſe had been another, which had been over, and had moved thither from the Northward before I went out: And during the whole time there were leſſer Lights towards the North, but diſperſed here and there, and not forming any large Body of Light. During the whole time, the Hemiſphere was clear, except a few very ſmall Clouds near the Horizon; and when any moved into the enlighten'd Arch, they broke the Connexion, ſo that the Light was above them: At the ſame time it froze hard each Night.

From theſe Obſervations, I ſuppoſe that the *Aurora Borealis* is a thin Nitro-ſulphureous Vapour rais'd in our Atmoſphere conſiderably higher than the Clouds, which is diſcontinued in ſeveral Places by the interſpers'd Air, and which by Preſſure and Motion is kindled; and perhaps the Exploſion of one may by its Shock and Motion contribute to kindle the next; by which means they go off one after another, till the whole Vapour within their Influence is diſcharged, and then the Light diſappears, and the thin Smoak appears, and undulates, according to the Motion in that part of the Atmoſphere. And hence I think, moſt of the Appearances may be ſolv'd: For 1*ſt*, As to the continu'd Light near the Horizon, they being at a great diſtance from us, and nearly in a Line, all theſe Exploſions may ſeem as a continued Light: When theſe approach nearer to us, and by conſequence appear higher in our Hemiſphere, we obſerve the Motion in each Flaſh, and ſtill ſeeing them laterally, yet ſomewhat breaking the

Con-

Continuity of the Light; they (by the Reflection of the Vapour floating in the Atmoſphere, and being not reflected, where the Air betwixt them is free of thoſe Vapours) may appear as Pillars: And as the Flaſh below and beyond them moves (as it kindles and expands) ſo they ſeem to move, and perhaps are ſhock'd at the ſame time by the Motion; but afterwards, when they are nearer, and raiſed to the Altitude of 40 Degrees, we get ſomewhat under them, and ſee the Expanſion of the Exploſion, which appearing ſomewhat globular, gives the faint Colours obſerved above, the Light not being intenſe enough to make them vivid; and afterwards when they riſe to, or near the Zenith, they are nigheſt to us, and then expand very wide at each Flaſh, like little Clouds: And I think, the great Objection of their appearing in the Northern Part of the Hemiſphere, and ſeldom or never in the Southern, is in ſome meaſure anſwer'd by the Appearance on the *26th*; ſince at leaſt half of the Arch was in the Southern Part of the Hemiſphere; and perhaps the Reaſon why the Light is not ſeen near the Horizon, in the Southern Part of the Hemiſphere, may be this, that in clear ſerene Weather, the Wind being generally near the North, Objects from thence are much more diſtinctly view'd, and at a greater diſtance than from the South; and 'tis generally known, that Lands at a great diſtance are moſt diſtinctly ſeen, when the Winds blow from them.

And perhaps a cold Northerly freezing Air may be needful to kindle the Vapours, when a contrary Motion above (higher in the Atmoſphere) may carry the Sulphureous Vapour, which falling down from the Nitrous Vapour may be kindled. Which, I ſuppoſe, form the Undulations of the Smoak after the Ex-

Explosion, which seemed, as above, like a stormy Sea moving from the S.S.E. Note, The Barometer was low for some Days before and after it.

I am, *&c.*

Arthur Dobbs.

III. *An Account of the* Aurora Borealis *that appear'd* Oct. 8. 1726. *In a Letter to the Publisher from the Reverend Dr.* Langwith, *Rector of* Petworth *in* Sussex.

THE Northern Lights have been so common in all Places of late Years, that tho' I have often seen them here, I did not think it worth while to write to you about them; but those that appear'd on *Saturday* the 8*th* of the last Month, were too remarkable to be pass'd over in Silence. They began about Sun-set; but I heard nothing of them till between 7 and 8. When I went out, I observ'd a Stream of Light almost due West, which was about seven or eight Degrees broad, and extended it self upwards about 35 or 40 Degrees. I had not a free Prospect of the Western Horizon, and so cannot tell what its Appearance was below. It was not perpendicular to the Horizon, but inclined a few Degrees towards the South. This Stream was of a dusky Red towards the North, but pale on the other side, and seemed to have a faint Mixture of the Prismatick Colours in it.

At

At the ſame time there appear'd a pale luminous Arch, whoſe Middle was nearly N. W. by N. The Altitude of its inner Edge was about 18 or 20 Degrees. This Edge was very diſtinct and regular all above, but a little confus'd towards the Horizon, where it extended it ſelf beyond the North-Point: How it terminated to the Weſt, I cannot inform you. From the upper Side of this Arch, which was waving, and ill defin'd, there ſhot up continually ſuch Streams of Light as have often been ſeen and deſcrib'd, ſince the Great Meteor of *March* the *6th*, 171⅝. The Sky under this Arch look'd exceeding dark, but was in reality clear; for we cou'd ſee the ſmalleſt Stars in it.

Nearly N. E. there was another Stream of pale-colour'd Light, which was about 7 or 8 Degrees diſtant from the Horizon, and was about as many in Breadth: It's Height was various, and ill defin'd. Towards the bottom of it, was an irregular black Cloud, which in ſome parts was near a Degree in breadth, in others hardly half ſo much: This Cloud was almoſt parallel to the Horizon. The Stream mov'd with a ſlow regular Motion towards the Eaſt.

In the S. E. was another Arch, like that in the N. W. by N. but not quite ſo high, or of ſo great an Extent. Between this Arch and the North-Eaſterly Stream the Sky was of an odd pale colour'd Light, with a mixture of Red in it.

From the South towards the Weſt were gloomy irregular Clouds, which now and then ſent out Flaſhes of Light.

About 8, the North-Eaſterly Stream ſuddenly expanded it ſelf every way: All its Parts began to be in a violent Commotion, and its Brightneſs increas'd to ſuch a degree, that I remember nothing like it in the former great Meteor of this Kind. All above it was of a

bright flame-colour; but below, it was edg'd with the Priſmatick Colours, which were full as ſtrong as I have ever ſeen them in the brighteſt Rainbow: They were not indeed ſo diſtinct; for, tho' I obſerv'd them as exactly as the ſtrange variety of their Motion wou'd permit, I cou'd only diſtinguiſh the Red, the Yellow, and a dusky bluiſh-Green.

This ſurprizing Sight did not laſt above a minute or two; but when the Colours vaniſh'd here, they began to appear in the North-Weſterly Arch, which was now become a portion of a larger Circle than before, and was not elevated ſo high above the Horizon. The Colours extended themſelves from the North towards the Weſt for about 15 or 20 Degrees; and tho' they were not ſo bright as in the other Place, yet they were more ſteady, and ſo as eaſily obſerv'd. Their Order was the ſame as before, the Red lowermoſt, and ſo on: Their Duration much longer.

In the mean time the Streaming Lights began to appear in all parts of the Heavens, and to form a *Corona* and Canopy, which were in all reſpects like thoſe of the great Meteor of 1715. Inſtead therefore of troubling you with a long detail of the Particulars of theſe, I ſhall refer you to the curious deſcriptions of the other by the Aſtronomer-Royal, and my late worthy Friend Mr. *Cotes*. I ſhall only take notice that the Colours of the *Corona* were neither ſo ſtrong nor ſo laſting as thoſe before deſcrib'd, and that the Top of the Canopy was ſometimes over-ſpread with a deep ſullen Red.

The Streams continu'd their direction upward towards a point of concourſe for a long time after, and form'd by fits imperfect Circles of pale Light about it: This Point, however, was not fix'd; for at firſt it ſeem'd to be in, or very near, our Zenith; but when I ob-

obſerv'd it ſome time after, it lay between the Stars in *Andromeda*'s Right-hand, and thoſe at the end of her Chain. The ſame Obſervation was made by a Curious Gentleman of this place, who alſo inform'd me that there was another luminous Arch which paſt quite thro' the Pole Star: It's continuance was ſhort, and I had not the good fortune to ſee it my ſelf.

Theſe Appearances held on in ſome degree till about 11, when the Air began to grow miſty, and ſo put an end to any farther Obſervations.

I cannot ſend you the exact Point of the Wind: It was ſo calm below, that I cou'd not be certain which way it ſtood; but ſome that were making their Obſervations from a high open Place, aſſur'd me, that it was North-weſterly, as it was in the Afternoon before, and the Morning after.

The Mercury was up at 30: The Weather mild and temperate.

I am afraid this Letter is already tedious, and yet I ſhall venture to lengthen it with the following Obſervations.

1. That It plainly appears from the Poſition of the Arches, that they cou'd not owe their Figures to the Sun: They ſeem to have been partly Optical, and partly to have depended upon the different Heights of the luminous Vapours; but for want of ſufficient *Data*, it will be no eaſy matter to determine how far each of theſe Cauſes concurr'd.

2. The Priſmatick Colours, wherever they appear'd, ſeem to have been caus'd by the Sun.

3. None of the Streams, as far as I could obſerve, proceeded directly from the Horizon. They were neareſt it towards the North, where there were ſome weak irregular Lights in the confus'd parts of the Arch before deſcrib'd.

4. I find by ſome of my Papers that during the Meteor of 171⅝. the Mercury ſtood at 30.2; ſo that the two Meteors agree, as in many other particulars, ſo in the following, *viz.* That the Air was calm, The Wind North-weſterly and the Mercury high.

I ſhall only add, that luminous Vapours in the Air are much more common than they are generally taken to be; for the Nights are very often lighter when the Sky is over-caſt, than in the brighteſt Star-light, tho' the *Crepuſculum* be quite gone off and there be no Moon.

I am, *&c.*

Petworth, Nov. 16. 1726.

B. Langwith.

IV. *The ſame Appearance deſcrib'd in a Letter to the Publiſher, by* Dr. Huxham, *Phyſician at* Plymouth.

THO' the Phænomenon, call'd *Aurora Borealis*, hath been frequently ſeen of late Years, even in this Part of the World; yet, I think, we have hitherto had but very imperfect Conjectures on the Cauſes of its Production. As I conceive a faithful Hiſtory of theſe Appearances will very much conduce to the Diſcovery of their true Cauſes, I do my ſelf the Honour to give you the following Account of that, which appeared the 8*th* inſtant, as we had it here at *Plymouth*. About half an hour paſt Six, perceiving *Jupiter* ſhone very bright, I was applying my Teleſcope to obſerve him, when on a ſudden ſeveral luminous Streaks appear'd about 10 Degrees above the Horizon in the N.E. and the Hemiſphere ſeem'd much enlighten'd. Imagining this to be the beginning of a *Lumen Boreale*, I caſt my Eye carefully along the Northern Horizon from E. to W. and very nearly in the W. Point I perceived, as it were, a vaſt red fiery colour'd Obelisk ſhot it ſelf up to the Height of 30 or 40 Degrees, which ſeem'd perpendicular to the Horizon, and its Baſe ſeem'd to inſiſt on it. Its Point almoſt touch'd the bright Star in the Northern Crown; a ſmaller Column or two ſtood near it, of the ſame Colour and Shape. The Light, in the mean time, to the Eaſtward increas'd conſiderably, and became more vivid; as when the Moon is behind a very bright

Cloud

Cloud. It alſo form'd it ſelf into Columns, which were projected to no great Height, and wou'd ſoon vaniſh, then ſoon return, and appear'd not only in the N.E. but alſo more Northerly.

In about a quarter of an hour from my firſt Obſervation, as from an Arch, or black Baſis (I know not better how to expreſs it) extended all over the Northern Horizon, which ſeem'd to interſect it nearly in the W. and E.N.E. Points, aroſe abundance of pyramidal Columns of Light on all parts of it; now here, now there, of unequal Bigneſs, Height and Luſtre; now ſuddenly gleaming forth, then as ſuddenly diſappearing; but thoſe Columns, that were to the Eaſtward of the N. were more bright and lucid than thoſe to the Weſtward, which were of a more fiery, rutilant Colour. The great Column in the Weſt ſtill remain'd in the ſame Poſition, Height and Shape; as I obſerv'd, by applying my Eye to a Wall very near E. and W.

Between the Arch and the Horizon, appear'd as it had been a black, dusky Fog, from whence the Streams of Light ſeem'd every where darted forth: Yet however black this appear'd, we could diſcern the Stars very clearly thro' it. This Arch at its firſt Appearance ſeem'd not to be above 15 or 20 Degrees (at its higheſt part) above the Horizon; but it continually grew higher, and from all parts of it Cones of Light were every Moment ſhot up, which all ſeem'd to tend to a Point near the Zenith (as the Vertical Circles or Arches on a Globe tend to its Poles) tho' as yet none reach'd it by ſeveral Degrees.

After 7 a clock the Columns to the Weſtward appear'd bright and vivid as thoſe in the E. except thoſe very near the W. Tho' the Limb of the Arch wou'd ſeem ſometimes very regular and well defin'd; yet at other times it wou'd ſeem to ſink, now in the middle, then at one part, then at another; and ſometimes it would

riſe

riſe with the ſame Irregularity: But it was certain, that during the whole time of the *Phænomenon*, no Light, or flaſhes of Light did appear in the black *Area* included between the Arch and the Horizon; even when it was at its geeateſt Height, which was about 10 or 12 Minutes before 8, when I judg'd it to be at leaſt 40 Degrees above the Horizon. Then from all parts of the Arch, but firſt from the Northern or higheſt parts of it, were Rays, or lucid Columns of a ſurprizing Brightneſs and Luſtre, darted with incredible Velocity towards the *Vertex*, where the Cuſps of of the converging Columns ſeem'd nearly to center; and ſuddenly from every Quarter of the Heaven, bright, ſhining Streams of Light were ſhot towards the Zenith; which meeting about 6 or 8 Degrees to the Southward of it, form'd a ſmall Circle of two or three Degrees Diameter, whoſe Border was much more lucid than near its Centre: This Circle ſeem'd form'd between *Cauda Cygni* and the *Lizard*, then nearly upon the Meridian.

This beautiful *Spectrum* might be likened to the Star worn by the moſt Noble Order of the Garter, but the pyramidal *Radii* were here revers'd; and from the Southward the Rays or *Striæ* were not near ſo long as thoſe from the N. eſpecially thoſe from the due S. not reaching above 10 or 15 Degrees from the Centre, or Circle; whereas thoſe from the Eaſtern and Weſtern Quarters were very long, and reach'd almoſt down to the Horizon; eſpecially in the E. and W. Points. The *Radii* were in a continual and exceedingly ſwift Undulation, and appear'd of ſeveral very bright Colours, as white, red, green, yellow, for ſeveral Seconds; but the moſt permanent and predominant Colours were a fiery Red, with an Eye of Crimſon, and a bright Pearl Colour: The red Rays came moſtly from the Weſtward, and that Colour continued till the entire

tire Diſſipation of this radiant Canopy ; the others dying away and leaving, as it had been a thin Smoak. The Vibrations of theſe radiant Columns were as ſwift as Flaſhes of Lightning, and inceſſant.

This ſurprizing Sight remain'd over us in its full Glory 3 or 4 Minutes, during which time the Rays were darted towards the Centre with prodigious ſwiftneſs, and did not ſeem to be ſhot from it. Sometimes they undulated like the Vapours ariſing from a Lime-Kiln, or from the Earth in very hot Weather, and all the upper part of the Hemiſphere ſeem'd to be, as it were, in a Convulſion.

In a ſhort Time this agreeable Scene vaniſhed, and was broken into ſmall flitting bright Clouds, which ſtill retain'd an undulating Motion; and Coruſcations wou'd every now and then break forth from them. At this time alſo I obſerv'd ſeveral Star-like Meteors fall, as is frequently obſerved in a bright ſerene Night.

Tho' our glorious *Cupola* diſappeared a very few Minutes after 8, yet very vivid Coruſcations were ſhot continually from the N. E. and N. W. Parts of the Heaven, which daſhing againſt one another near the Zenith, formed by their Colliſion momentany Arches of a Circle, nearly in the ſame Place and of the ſame Diameter with that above mentioned. None now proceeded from the South, and very rarely from the true North. The Coruſcations were always more red and fiery from the Weſtward than from the Eaſt, which were always more bright and luminous.

We were loſt in the Contemplation of the beautiful *Phænomenon* over our Head, and did not obſerve the Formation of a lucid Arch projected over all the Northern Horizon, which ſeemed like the Arch of

of a Rainbow, of one vivid, bright, yellowiſh Colour, and all under was, as it were, a very dark Cloud; tho' by viewing it with a Teleſcope, we could diſcern the minuteſt Stars: So that the Darkneſs only proceeded from the greatneſs of the Light juſt above it. From this, as from the former, aroſe very lucid, bright Columns on all parts of it. No Coruſcations appear'd under it. Its greateſt Height might be 20 or 30 Degrees. Some of the Columns ſeem'd to radiate even to the Zenith from this Arch.

About 9, this lucid Arch vaniſh'd inſenſibly, with moſt of the luminous *Radii*, or Columns; but, as it were, a very bright *Crepuſculum* ſtill remained all along the Northern Horizon, and ſeveral very bright Coruſcations would ſeem to be ſhot out of the pure Sky: This, more eſpecially, was obſerv'd in the N.E. About 11, I obſerved ſeveral Coruſcations ſtill breaking forth, and here and there a luminous Column; and ſeveral little bright Clouds ſeem'd irregularly ſcatter'd up and down the Hemiſphere, which ſtill retain'd their darting and quivering Motion. The Northern *Crepuſculum* remain'd as bright as ever, and ſo continued till paſt Two in the Morning.

There were but very few, and thoſe very ſmall Clouds to be obſerved during the whole time of this *Phænomenon*, and the Air was clear; yet all around, and between the lucid Columns, whenever, or in what part ſoever they appear'd, the Air would ſeem very thick and hazy; tho' immediately upon the diſappearing of thoſe gleaming Lights, the Sky would in the ſame Place appear very clear and ſerene. Nay, even thro' ſome of the very Columns we could plainly diſcern the Stars. Some Gentlemen thought they ſaw the bright Stars of the Swan thro' the *Corona* it ſelf.

As to the Weather preceding and following this *Phænomenon*, I need not be very particular, ſeeing you will ſoon have it in my Meteorologic Obſervations. The Morning was fair, tho' the Air was thick, and we had a great Dew: The Mercury was at 30 Inch. *Hawksby*'s Thermometer at 50, little, or no Wind. The Day was pleaſant and warm, and the Air grew much thinner. The Evening was ſerene; a very ſoft Breeze from N. and by W. About Five the next Morning, there were ſeveral Clouds form'd, and the Air was very thick and hazy, at Seven it was all Cloudy, and a few Drops fell.

Tho' I had before ſeen ſeveral faint Appearances of the *Aurora Borealis*; yet this, for Beauty, Luſtre and Duration, vaſtly exceeded any thing of that nature I had ever ſeen. Indeed, I ſaw not that of *March 6th*, 1716, being not then in *England*.

I am, &c.

Plymouth, Oct. 16, 1726.

J. Huxham.

V. *A Letter from Dr.* Hallet, *Phyſician at* Exeter, *to Dr.* Henry Pemberton, *F. R. S. on the ſame Subject.*

Exon. Octob. 12, 1716.

Octob. 3, 1726, at Nine in the Evening, I ſaw an *Aurora Borealis* (as 'tis commonly call'd,) in which there was nothing different from former Appearances, excepting that from the luminous Arch which appear'd in the North, were frequently ſhot off Parts of Arches towards the Zenith, which vaniſh'd there.

Oct. 8, Coming from the Country near Seven in the Evening, I obſerv'd a great Light in the Eaſt and Weſt, which ſoon extended it ſelf over our Heads, the North and South appearing dark at the ſame time. No Cloud was ſeen all that Day. A great Dew fell on a ſudden, with which the Streets were wet, as by a ſmall Rain. Half an Hour after Seven many Streams appeared in the North, which grew very bright, and darted frequently up to the Zenith. A Line drawn through the Baſes of them, made an Arch of a Circle, extending from the N. E. to the W. or S. W. But the Streams ſeemed to proceed from a clear Sky being diſtinct from one another at the Baſes, and not united by a luminous Arch or Cloud, as in the more uſual *Aurora's*. The Streams at the two Extremities of the Arch were brighter, wider and longer when they did not ſhoot, than thoſe on the Top of it. [See Fig. 1.] There was at the ſame time a luminous Arch extending it ſelf from the two Extremities of the above-mention'd *Aurora* through the South, at a conſiderable Altitude. About Eight o'

clock the Streams began to have an Horizontal Motion, propagating themſelves on both ſides towards the South; and in a Minute or two the whole Heaven was ſurrounded with them. Immediately they all extended themſelves up to a Point near the Zenith (I think, a little towards the Eaſt) where their Points were blended together in a confus'd manner. At the ſame time, every Stream, which before was white, appear'd ſtriped with all the Colours of the Rainbow; but the moſt prevailing Colour was a deep Red. It is impoſſible to expreſs the Beauty of this glorious *Umbrella*, which cover'd the whole Hemiſphere with its variegated Rays, the Colours of which ſucceeded one another in a regular Order. In the Center of theſe Rays was a confus'd Rolling, Agitation or Ebullition of a luminous Cloud, appearing like Smoak. In about ten Minutes (as I imagine) the Colours diſappear'd, and the Streams began to retire from the Zenith; preſently after which, they would frequently dart and ſhoot with great Celerity up to the ſame Point. This Darting and Flaſhing, together with a tremulous Motion from all ſides of the Horizon, I obſerved till 12. And I am informed by others, that it continued till Four in the Morning. The moſt conſiderable Rays came from the Eaſt and Weſt. Next Morning we had a Fogg.

The beſt Account which I can give of this *Phænomenon* is this: I imagine a thin Cloud compoſed of a Sulphureous Exhalation, hanging over us in the Air, at a conſiderable Height, parallel to the Horizon; the Length of it being very great from Eaſt to Weſt nearly; the Breadth of it (at firſt) not ſo great, but that we might ſee the Stars from under it to the North and South. The North Side of it, I ſuppoſe, firſt took Fire,

Fire, and ſhot its Streams or Flames perpendicularly upwards, which being undiſturb'd by Winds, muſt appear ſtreight and pointed at the Top. The Baſes muſt make an Arch by the Rules of Perſpective: For, I think, an Horizontal Right Line, of a vaſt Length, and at a great diſtance from us (ſuch as I take the Northern Edge of this luminous Cloud to have been,) ſeen at a conſiderable height in the Air, muſt appear bent down into an Arch. On a ſudden the Fire propagated it ſelf to all parts of this Vapour. The whole Heaven muſt then appear cover'd with the ſame Streams, which tho' really parallel to one another, muſt appear bent into a *Cupola*. The ſhooting and darting of theſe Flames, and their Concourſe, together with a Smoak proceeding from them, muſt give that confus'd Cloud which was obſerved in the Center of this Canopy. The regular Diſpoſition of the Colours in every Stream, perhaps, you may account for. I think, the Red appear'd at the right hand in all of them. Somewhere in the *Philoſ. Tranſact.* I have met with an Obſervation of an *Aurora*, in which the Streams were colour'd only where they met, or croſs'd one another. Whether the Light of one Stream paſſing thro' another, may not be ſeparated into Colours by Refraction, I will not determine. You may think of a better Solution. If the Altitude of the Top of the Arch in the North had been taken here, and at the ſame time at another Place upon the ſame Meridian, whoſe diſtance is known, from thence I imagine, the Height of the Cloud (as I call it) might have been calculated.

I am, *&c.*

Wm. Hallett.

VI. *The ſame Appearance deſcrib'd by* John Hadley, *Eſq*; *F. R. S.*

THE *Royal Society* hath received ſo many and ſo full Accounts of the frequent Northern Lights, which of late Years have been ſeen in *Europe*, and particularly of that remarkable one of the 8*th* of *October* laſt, that it ſeems needleſs at preſent to give a minute Deſcription of the whole Appearance. I ſhall therefore only take notice of a few Particulars, which either have been omitted by others, or by ſome remarkable Circumſtances attending them, ſeem moſt likely to be of uſe to thoſe who employ their Thoughts in attempting to diſcover the Nature and Cauſes of theſe *Phænomena*.

The firſt ſight I had of this Appearance, was about half an hour after Seven of the Clock; at which time it had nothing remarkable to diſtinguiſh it from thoſe others which had been obſerved almoſt every Evening for ſome time, except a dusky Redneſs ariſing from the Weſtern Extremity of the luminous Arch; and that at the ſame time there was ſeen another like hazy Arch low to the Southward, fainter, but more ſteady than that to the North. I judg'd the higheſt Point of it to be ſomething more elevated than the Sun at Noon about the Winter Solſtice.

In a ſhort time after, the Northern Arch was riſen conſiderably higher from the Horizon, and continued to advance towards the Zenith, till 8; when in one part it paſs'd among the uppermoſt Stars of *Caſſiopeia*, and in another cloſe below the bright Star in the *Harp*.

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The Heavens underneath look'd clear, and of a dark Blue, having no reſemblance either of Dawn or dusky Cloud, and the Pyramids of Light ſeem'd to ſpring immediately out of the pure Sky. The Arch it ſelf was very irregular, being full of Notches, ſome greater, ſome leſs. The dusky Red on the Weſt was changed to a light Crimſon, and was anſwer'd by the like Colour on the Eaſt. The Rays iſſuing from both Extremities, were thick and bright, appearing as if there were ſeveral one behind another. They were alſo generally longer than the reſt, and pointed conſiderably to the South of the Zenith. After 8, the Northern Arch retir'd again downwards, till it came among the Stars of the *Great Bear*; when the whole Scene was changed on a ſudden, and Rays were darted up from all ſides, and form'd that Crown-like, or Star-like Figure which has been ſufficiently deſcrib'd.

The intermediate *Area* (left between the innermoſt Extremities of the Rays coming from different Quarters, which very rarely, if ever, joyn'd) was of an irregular Figure, commonly inclining to an Oval, whoſe longeſt Diameter lay Eaſt and Weſt. Sometimes it appear'd as clear Sky, at other times was fill'd with a thin white Cloud, and that Cloud was often divided into two Parts, by an uneven crooked Line, running likewiſe Eaſt and Weſt.

The Rays which immediately ſurrounded this void Space, were of no great Length, and very unſtable: Yet two or three times, when they continu'd ſteady enough to afford an Opportunity of conſidering them attentively, their outermoſt Extremities were ſenſibly carried Southwards, the Center it ſelf remaining, to appearance, fix'd.

The Southern Quarter was fill'd with continual Flaſhings of Light. Theſe followed one another very quick, and were propagated upwards from the aforemention'd Arch with great Swiftneſs, each of them leaving in ſome parts of the Space it paſs'd through, a faint, and very tranſient Whiteneſs, which preſently vaniſh'd, and was quickly renew'd, uſually in the very ſame Track, by the next ſucceeding Flaſh. Yet none of thoſe Tracks were in any degree direct and uniform; but all very irregular and broken.

The Central Figure ſometimes diſappear'd for a while, and then returned again. Whether it always retained the ſame Situation with reſpect to our Horizon, I cannot depend on the Exactneſs of my Obſervations enough to determine. They were as follow.

About half an hour paſt Eight, the Center, as well as I could judge by my Eye, was very near a Star of the fifth Magnitude, placed by *Hevelius* at the End of the *Lizard*'s Tail, whoſe preſent Right Aſcenſion is about 331°, and Decl. 36° and an half N. At Nine, it was at the Northern Point of an *Iſoſceles Triangle*, whoſe Baſe was a Line joyning the Star in *Pegaſus* Shoulder, call'd *Scheat*, and the brighteſt of thoſe in his Knee; the Perpendicular from the Center being in proportion to the Baſe, about as 3 to 2. At 9h. 15′ the *Triangle* made between that and the two forementi-on'd Stars was become Right-angled at *Scheat*, the Diſtance being not much alter'd. At Ten, it was directly between the Zenith and *Andromeda*'s Head, at a Diſtance from this Star not ſenſibly different from what it had kept from the Northermoſt of the Two forementioned.

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According to the first of these Observations, the Central Point must have been very near the Meridian, and about 15° South of the Zenith of the Place where I was; which is a few Minutes directly North from *London*. The three last agree pretty well with one another, to carry it between 2 and 3 Degrees further Southward, and to give it a perpendicular Distance of 3 or 4 Degrees of a great Circle from the Meridian Eastward.

In the remarkable Appearance of this kind which happen'd the 6th of *March* 171$\frac{5}{6}$, I observ'd the like Center at near half an hour after 7 o' clock, to be something nearer the Zenith, than the bright Star in the Northern Head of the *Twins*, and to be more Easterly by about half the Distance between that and the Star in *Pollux*'s Head. By comparing this Observation with the Situation of the Star at that time, the Center appears to have been about 16 or 17 Degrees from the Zenith, and about 2 or 3 distant from the Meridian Circle towards the East.

VII. *De eodem Phænomeno* Genevæ *viſo, Epiſtola Viri Clariſſimi Domini* Johannis Ludovici Calandrini, *Math. Prof. Ordinar.* Genevæ, *ad* Jac. Jurin, *R. S. Secr.*

Datam Genevæ *Kal.* Nov. 1726.

DIE Saturni $\frac{19}{8}$ Menſis Octobris, horâ ſextâ & dimidiâ veſpertinâ, Aurora Borealis fulgere cœpit, Phænomenon vobis quidem ſatis familiare, nobis verò ex ſeniorum ſententiâ planè novum, ſed tam illuſtre, & circumſtantiis à vulgaribus in Tranſactionibus ſæpe deſcriptis tam diverſum, ut de eo audiiſſe fortaſſe non pigebit.

Primò quidem, quâ horâ dixi, Arcus lucidus viſus eſt, cujus medium ſtabat in Horizontis Septentrione, extremitates ad Arcturum in Occaſu, & ad Pleiades in Ortu, 40° altus; lucidus ſatis, ut Solem è Septentrione jamjam ortum ire diceres; ſed hic nihil eſt novi.

Poſt horam ſeptimam, quaſi violenti incendii flammæ, vel continua fulgura totum albicantis arcus locum occupaverunt. Serpebant ex Horizonte ad cœli fornicem haud abſimiles veri furni flammis, extremitates arcûs rubicundo atrove fulgore vulgum terrebant, ipſæ flammæ in atrum fumum deſinere videbantur, ita ut diem Domini inſtare mulierculæ non dubitarent. Cœleſte hoc incendium pluſquam horam duravit; Scenâque mutatâ, ex Horizonte exilire columnas, quæ ad Zenith pertingerent, viſum eſt: Ex eâdem ſupradictâ baſi, coronâ in extremitate Phænomeni tum occidente & cornu Tauri inferiore ab alterâ parte ſurgente, columnæ plus minuſve latæ, 60 aut 70° altæ, tria vel qua-

quatuor minuta durantes, paulatim evaneſcentes, vel prius in igneum colorem verſæ ; poſt aliquod tempus ceſſarunt columnæ : tum Aurora Borealis ut primum fulſit, cui ante decimam ſucceſſerunt flammæ vehementiores quam prius, quibus ceſſantibus columnæ circa undecimam viſæ ſunt, magis diutinæ, & 120? plerumque altæ : Rurſus Aurora, mox flammæ, poſtea columnæ, atque ita ad tertiam uſque, quâ videbantur adhuc Phænomeni relliquiæ.

Ultra luculam, quæ ſemper Septentrionalem, quam dixi, cœli partem illuſtrabat, majoris Urſæ ſtellæ parum fulgebant. E Veſontio, quod 90 milliaribus hinc diſtat, eodem modo viſum fuiſſe Phænomenon accepimus.

Arſit interea unum ex illis Meteoris, ſtellæ cadentes dictum, quod ultra Phænomenon arſiſſe viſum eſt.

Ex reflexione Solaris luminis à partibus Atmoſphæræ Borealibus congelatis Auroras Boreales formari dictum eſt : Sed flammas adeò notabiles quo pacto explicentur non video. Si ab exhalationum incendiis ortum hoc Phænomenon cenſeatur ; Aurora Borealis Phænomeni comes, columnæ, duratio Phænomeni, & ipſius in eodem loco ſtatio, negotium faceſſent.

Joh. Lud. Calandrini.

VIII. *An Account of a præternatural Bony Subſtance found in the Cavity of the* Thorax, *communicated in a Letter to Dr.* Rutty, *by Mr.* William Giffard, *Surgeon.*

ON *Tueſday*, *May* the 10*th*, 1726, I open'd the Body of a Perſon, who dy'd the foregoing Day of a *Peripneumonia*; in the right ſide of whoſe *Thorax* I found an oſſeous Subſtance about the fourth of an Inch thick, ſix Inches long, and three broad, extending it ſelf under the third, fourth, fifth and ſixth Ribs, cloſely and ſtrongly connected to the *Perioſteum* of the Ribs, and the *Tunica propria* of the inner Intercoſtal Muſcles, by Fibres which ſhot from a ſtrong and thick intervening Membrane, which cloſely adher'd to its outer Surface or Back, and was continu'd over its inner likewiſe, thereby forming a *Capſula* for this præternatural Subſtance. Its upper Edge lay immediately below, and was contiguous to that Part of the Ribs, where they become cartilaginous: The Membrane that adher'd to, and cover'd it, continu'd thick ſome diſtance from it, and gradually grew thinner, and was at length loſt in the *Pleura*; from whence I judg'd this extraneous Body to have been form'd between the two *Lamellæ* of that Membrane. The Lungs ſo ſtrongly adher'd to its Inſide, that upon ſeparating them, part remain'd to it: Upon cutting into which, I obſerv'd all the Cells ſtuff'd with a thin, but ſomewhat digeſted *Pus*.

Upon farther Enquiry, I found on the ſame ſide, towards the Back, another Subſtance, but perfectly Bone, inveſted as the former, with a ſtrong and thick Membrane

brane, and by the Fibres which ſhot from it, tied to the Body of the *Vertebræ*, and the fourth, fifth, ſixth and ſeventh Ribs, and Intercoſtal Muſcles.

Its Back or Outſide was convex, agreeable to the concave Surface of the Ribs, which had made Indentations on that part of it where they preſs'd: Its Inſide was concave as the Ribs; the right Lobe of the Lungs ſtrongly adhered, part of which for that reaſon remained to it after Separation: Its Length was about ſeven Inches, Breadth about three from Edge to Edge: Its Thickneſs, in ſome parts a third, in others a fourth of an Inch. It had, as the former, a thick Membrane running from it, which gradually thinning was at length loſt in the *Pleura*; from whence I judge this extraneous Subſtance to have been formed as the foremention'd.

" Since Mr. *Giffard* has not inſerted the Particulars " of this Gentleman's Indiſpoſition, I ſhall add, that " upon Inquiry, I have ſince been inform'd, that he " was troubl'd for ſome Years with a ſhort Cough, " which latterly was accompanied with a difficulty " of Breathing, and great Labour in Inſpiration; and " ſome time after, with a Weight and Pain on the " right Side; which Symptoms encreaſing more and " more, brought on the *Peripneumonia*, of which he " died in a few Days. The Riſe and Succeſſion of " thoſe different Symptoms proceed ſo naturally " from the Formation and Growth of this præterna- " tural Body, as well as the particular part of the " *Thorax* where it was lodg'd, that it is entirely need- " leſs to ſay any thing more upon them.

W. Rutty.

IX. *An*

IX. *Obſervatio de Succinea Gleba, Plantæ cujuſdam folio impregnata, rariſſima.* *Auctore* Dno. Johanne Philippo Breynio, *M. D. R.S.S.*

INter Corpora Naturalia Succinis à Natura incluſa, illa longe rariſſima eſſe, quæ Vegetabili Regno ſuam debent originem, confitebitur mecum, opinor, quicunque Naturæ Curioſorum Pinacothecas, inque iis Succineas Gazas, non levem ipſis conciliantes ſplendorem, accuratius inſpexerit, Authoreſque de his rebus tractantes diligentius excuſſerit. Hæc inter autem cæteris Plantarum perfectiorum partes, ut foliæ, ſeminum receptacula, flores, ſi qui inveniuntur, &c. raritatis palmam præripiunt.

Hujus rei ratio procul dubio eſt, quod ex recentiorum mente, Succinorum officina naturalis, loca ſint ſubterranea, quorſum partes Vegetabilium, utpote terræ ſuperficiem inhabitantium, ægre et non niſi caſu, eoque rariſſimo pertingere poſſunt; cum Inſecta, quamvis etiam in aere viventia, tamen, ut ſe à frigore, aliiſque aeris injuriis defendant, vel alia etiam de cauſa, ſponte ſæpius rimas, hiatus et cryptas quærant et ſubeant ſubterraneas, & ad ſepulchrum properent, ubi à Succino adhuc liquido irretiuntur, involvuntur, ſuffocantur, cumque eodem in ævum duratura rigeſcunt.

Ejuſmodi glebam, quæ folium hujus notæ in ſinu ſuo fovebat, nuper Menſe Octobri præterito mihi exhibuit & examini ſubjecit meo hic *Gedani* Mercator quidam natione *Britannus*, *Philippus Benlows*, qui eandem,

dem, inter alia Succina nactus, maximi, imo pluris quam triginta aureorum æstimabat.

Hæc ovalis ferme, sed compressæ erat figuræ, & magnitudinis, quæ in Icone Fig. 11. adjuncta exprimitur, quartam Unciæ partem crassitie æquans, illius generis, quod falernum, à similitudine vini, salutatur Succinum, & quidem satis perspicua & pura, neque vel leviſſima fraudis macula conspurcata. Includebat per totam ejus mediam longitudinem exporrectum Folium aliquod Botanicis pennatum, quibusdam etiam alatum, quamvis minus recte, dictum; quod eleganti sane spectaculo, obscurum quidem, sed aureo colore coruscans, à reflectione & refractione radiorum luminis, oculis spectantium clare sese offerebat. Folium hoc non integrum, sed utraque extremitate mutilatum erat, ut ipsa indicat figura, quinque constans foliolorum oblongorum, utrinque non nihil acuminatorum paribus s. conjugationibus; quorum quædam erant ex parte exesa et mutila, in costa communi æque fere à se invicem distantibus. Situm erat in plano horizontali, quod in eo foliorum genere familiare est, præterquam, quod foliola obliquitate aliquantulum ab eo deflecterent; nequaquam vero conjugationes foliolorum decussatim positæ vel ullo modo videbantur, quod in foliis, quæ conjugata Botanicis dicuntur, semper obtinet; ut adeo folium hoc ex compositorum pennatorum genere esse, nullum mihi amplius restet dubium. Cujus autem exacte Plantæ speciei sit determinare vix licet; quia multæ species hujus familiæ, foliis vestiuntur sibi adeo similibus, ut etiamsi recentia, difficile sit à se invicem distinguere; accedit, quod nec venulæ foliolorum, vel oculis Microscopio armatis appareant, utpote quæ à Succino olim liquido obliteratæ & quasi incrustatæ erant. Quam proxime autem accedit ad Securidacæ secundæ, *Clusii*, s. Coronillæ

nillæ herbaceæ, &c. *Tournefortii*, quæ in dumetis *Pruſſiæ* ſatis familiaris eſt. Ab altera parte, inter bina foliola, aranea ſatis clare conſpicitur; ab altera vero parvula muſca, ſed hæc non niſi oculo lente armato.

Non memini me apud ullum Authorem folii hujuſmodi in Succino pennati inveniſſe mentionem, præterquam apud *Michaelem Mercatum* in nobili iſto opere Metallothecæ Vaticanæ titulo inſcripto, & immortalibus Archiatri Pontificii *Johannis Mariæ Lanciſii* meritis à ſitu, oblivione & interitu liberato. Ubi, pag. 89. inter alias elegantium glebarum Ranam, Piſciculum, Lacertulam variaque Inſecta continentium Icones, una etiam reperitur, quæ folium ejuſmodi pennatum paulo minus, ſed ob integritatem rarius & elegantius, octo conjugationum, foliolo extremo impari coſtam claudente, includit; quod parvum & tenellum Coronillæ herbaceæ, flore vario, *Tournefortii*, folium egregie exprimit, quamvis etiam non male ad Onobrychidem ſecundam, *Cluſii*, quæ pariter *Pruſſiæ* indigena eſt, referri poſſet.

Idem *Mercatus* aliam ibidem delineat glebam parvo in tenuia ſegmenta diſſecto folio, plantæ cujuſdam, forte umbelliferæ, imprægnatam.

Interim tamen cum glebas memoratas, in laudato *Mercati* libro ſaltem, ſummo licet ſtudio delineatas, non vero ipſas viderim, præterea figuræ Ranæ majoris, Lacertulæ & Piſciculi, non levem mihi artificioſæ fraudis excitent ſuſpicionem, ego equidem pro genuitate earum vadium in me ſuſcipere nollem; quia notum eſt affatim, Artifices, ejuſmodi res adeo artificioſe Succinis poſſe includere, iiſque non nimium Curioſis imponere, ut non niſi ab experiſſimis & oculatiſſimis poſſit detegi fucus.

X. *Obſervatio Defectus Solis habita* Patavii *VII. Cal.* Octob. 1726. *a Viro Cl. Domino* Johanne Poleno, *Aſtr. Prof. R. S. S.*

Temp. Appar. H.			
	I	*II*	
5	25	25	Initium Defectus hoc tempore nullum apparebat: tum poſt tempus hoc ingruerunt denſæ nubes.
			Dig. Obſcur.
29	5		1
31	48		Tegitur maxima earum, quæ conſpiciebantur in Sole, Macula, intermedia inter minores duas alias
			Dig. Obſcur.
34	27		2
40	43		3
44	20		$3\frac{1}{2}$
47	15		4
48	12		$4\frac{1}{4}$
49			Creſcebat certe adhuc Obumbratio in Solari Diſco, ut trans nubes apparebat: mox vero cum denſiores fierent nubes, atque Sol ad Finitorem properaret, nihilquicquam amplius licuit obſervare,

XI. *Observatio Defectus Lunæ habita (tubo optico optimæ notæ, longo pedes* Parisienses *septem)* Patavii *VI. Id.* Octob. 1726. *ab eodem Viro Clarissimo.*

Temp. Appar. H.	′	″	
16	16	44	Penumbra diluta.
	18	54	Penumbra densior.
	21	19	Umbra ad Lunæ limbum.
	31	35	Attingit Mare Humorum.
	35	47	Attingit Grimaldum.
	38	34	Distat a Tychone diametro Tychonis ipsius, & Grimaldum tegit tertia ejusdem Grimaldi parte.
	50	40	Fere attingit Pitatum.
17	3	41	Lansbergium tegit.
	7	45	Attingit Reinoldum.
	15	56	Attingit Fracastorium, & Galileum.
	25	53	Attingit Mare Fœcunditatis.
	39	6	Umbra proxima est ad Reinoldum, tegitque partem tertiam Maris Fœcunditatis.
	46		Grimaldus emergit.
	54	53	Grimaldus jam distabat ab umbra diametro majore sui integra.
18	5	44	Gassendus totus modo extra umbram, Mare Fœcunditatis dimidia cirtiter parte detectum, inter dehiscentes nubes videbantur.
			Quæ nubes ad Finitorem deinde coactæ occiduam Cæli partem penitus obumbravere; neque Luna posterius apparuit.

XII. *Two newly discover'd Arteries in Women, going to the* Ovaria. *By Mr* Ranby, *Surgeon to his Majesty's Houshold, F. R. S.*

SOmetime ago I presented the *Royal Society* with a Description of two * Arteries, which arising from the *Aorta*, and sending Branches to the *Glandula Renalis*, then descend to the *Testicles*. And I have since found the same Arteries in Women, descending in the same common *Capsula* with the Spermatick Artery and Vein, to the *Ovaria*. These Arteries very probably are what the late Excellent Anatomist *Valsalva*, took for excretory Ducts of the *Glandulæ Renales*, the Disposition and Progress of these being very much alike to what has been ascrib'd to those supposed Ducts.

* *v. Phil. Trans.* N°. 387.

F I N I S.

FINIS

Fig. 1.

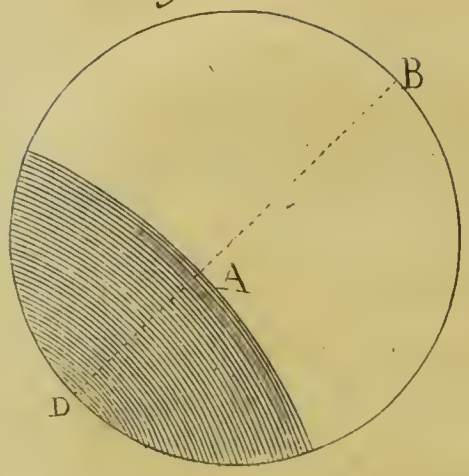


Fig. 2.

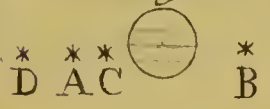


Fig. 3.

Fig. 5.

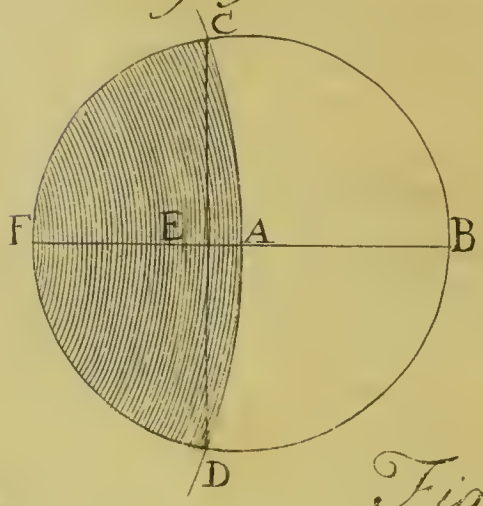


Fig. 4.

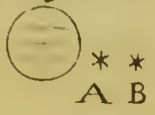


Fig. 6.

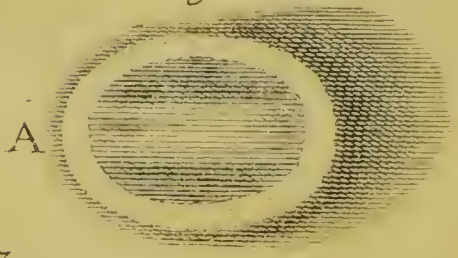
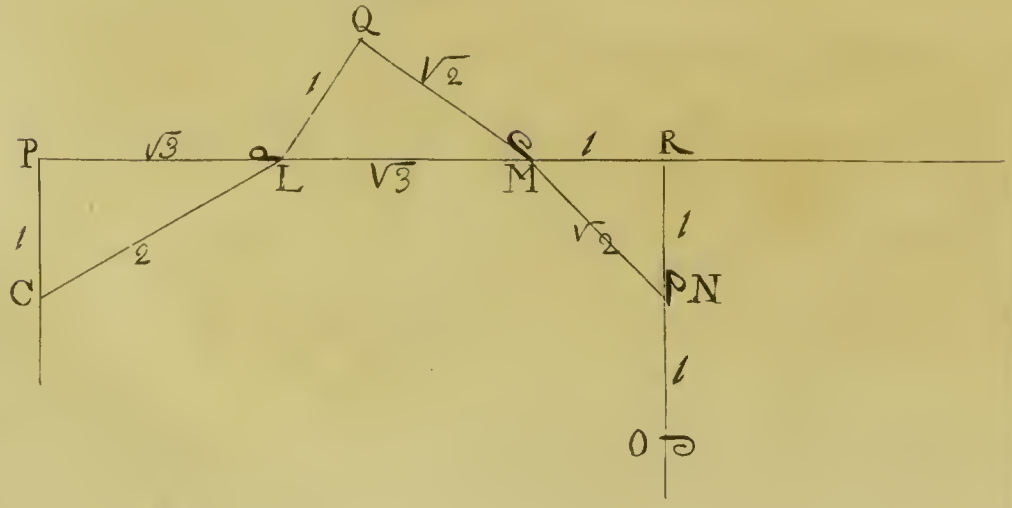


Fig. 7.



Numb. 396.

PHILOSOPHICAL TRANSACTIONS

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VIII. *Brevis Commentatio de Cobalto, Auctore Viro Clariſſimo* Joh. Henr. Linckio, Lipſienſi *Acad.* Cæſar. Leopold. Carolin. *Nat. Curioſ. & Soc. Reg.* Anglic. *Sodale.*

I. *A ſhort Account of Negativo-affirmative Arithmetick, by* Mr. John Colſon, F. R. S.

THE Uſefulneſs of this Arithmetick conſiſts in this, that it performs all the Operations with more Eaſe and Expedition than the common Affirmative Arithmetick, eſpecially in large Numbers: And it differs from the common Arithmetick chiefly in this, that it admits of Negative Figures promiſcuouſly with the affirmative. Theſe negative Figures are diſtinguiſh'd from the Affirmative, by the Sign - placed over them. Thus $3\bar{7}09\bar{2}8\bar{6}57\bar{3}96\bar{1}47\bar{2}$ is one of theſe Numbers, which may be converted into its Equivalent common Number 23087264320394 68, in this manner:

$$\begin{array}{r} 3009006503000470 \\ 0700280070961002 \\ \hline 23087264320394 68 \end{array}$$

(1.) Write down all the affirmative Figures by themſelves, putting a Cypher in the place of every negative Figure. (2.) Write down all the negative Figures by themſelves, putting a Cypher in the place of every affirmative Figure. (3.) Subtract the laſt Number from the firſt, and the Remainder will be a common Number, equivalent to the given negativo-affirmative Number. See the Operation above.

But the readieſt practical Way of performing this Reduction in any given Number, will be in this manner: Begin at the left hand; and going over all the Figures in order, obſerve theſe Rules. (1.) An af-

 firmative

firmative Figure before a Negative must be diminish'd by an Unit. (2.) A negative Figure before an Affirmative, must be changed into its Complement to 10. (3.) A negative Figure before a Negative, must be changed into its Complement to 9. All other Figures must remain unchanged, and a Cypher is always to be understood where there is no significant Figure. The sign of the Cypher is neglected; but where there is occasion to consider it, it is always suppos'd the same as the Sign of the following Figure. Thus the negativo-affirmative Number $7\bar{2}9\bar{5}86\bar{4}55\bar{9}8\bar{2}00\bar{1}730$ is immediately reduc'd to 7105855459779983 30; and so of all others.

But on the contrary, common Numbers may be reduced to negativo-affirmative Numbers a great variety of Ways, by substituting instead of the Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, their respective Values $1\bar{9}$, $1\bar{8}$, $1\bar{7}$, $1\bar{6}$, $1\bar{5}$, $1\bar{4}$, $1\bar{3}$, $1\bar{2}$, $1\bar{1}$, in any places at pleasure. But the most useful Reduction of this kind is what I call *A Reduction to small Figures*, which consists in throwing out all the large Figures, 9, 8, 7, 6, out of any given Number, and introducing in their room the equivalent small Figures $1\bar{1}$, $1\bar{2}$, $1\bar{3}$, $1\bar{4}$, respectively. Thus 182937462 may be reduc'd to $2\bar{2}3\bar{1}4\bar{3}5\bar{4}2$, consisting only of small Figures. But this Reduction may be perform'd more readily by these Rules following.

(1.) A small Figure before a large Figure must be increased by an Unit. (2.) A large Figure before a large Figure must be changed into its negative Complement to 9. (3.) A large Figure before a small Figure must be changed into its negative Complement to 10. Other Figures are not to be changed; and 5 will be ambiguous, being to be esteemed either large

or

or ſmall, according as the Figure following is either large or ſmall. Some Examples of this Reduction ſhall here follow, both in whole Numbers and Decimal Fractions.

$$37068259764 = 4\bar{3}1\bar{3}2340\bar{2}44$$
$$7295289607399\bar{5}7 = 1\bar{3}3\bar{1}5\bar{3}10\bar{4}1340\bar{0}\bar{0}\bar{4}\bar{3}$$
$$92608723\bar{9}5,87294 = 1\bar{1}34\bar{1}\bar{1}32404,\bar{1}33\bar{1}4$$
$$\text{Or } (9)926087239587294 = (10)\ 1\bar{1}34\bar{1}\bar{1}3240\bar{4}\bar{1}3\bar{3}\bar{1}4$$
$$(m)387916407953,\&c. = (m)\ 4\bar{1}\bar{2}1\bar{2}44\bar{1}\bar{2}153,\&c.$$

It is to be obſerved, that in this laſt Example the Numbers are what I call *interminate*, or Approximations only; that is, the firſt and moſt valuable Figures are expreſs'd, and all the reſt (whether finite or infinite in Number, whether known or unknown) are omitted as inconſiderable, and inſinuated by the Mark &c. Alſo the Index *m* before the Number ſtands for ſome Integer, expreſſing the Diſtance of the firſt Figure 3 or 4 from the Place of Units; which Integer is either affirmative or negative, according as the ſaid firſt Figure ſtands in integral or fractional Places. The Example immediately before is a particular Inſtance of this.

And thus much by way of Notation: To proceed therefore to the Operations to be performed with theſe Numbers, whether reduced to ſmall Figures or not; and firſt of Addition.

Place the Numbers to be added juſt under one another, obſerving the Homogeneity of Places, as in common Numbers. Then beginning at the Right Hand, collect the Figures in the firſt Row or Column, according to their Signs, and place the Reſult under-

neath: And ſo ſucceſſively of all the other Columns, as in Example 1.

But if at any time this reſult cannot be expreſs'd by a ſingle Figure, it may be writ down with two or more Figures, obſerving the Homogeneity of Places, and then the Sum may be collected over again. But to ſave this trouble, it will be ſufficient to reſerve the Figure in mind which belongs to the next Column, and collect it with the Figures of that Column; as in Examples 2, 3.

If the Numbers to be added are reduced to ſmall Figures, as in Example 3, their Addition will be very ſimple, and the Sum may alſo be exhibited in ſmall Figures, by an eaſie Subſtitution of Equivalents, where there is occaſion.

(1.)

$$\begin{array}{r} 257\,384\,263 \\ 709\,821\,370 \\ 5\,807\,305 \\ \hline 953\,364\,212 \end{array}$$

(2.)

$$\begin{array}{r} 647\,039\,682 \\ 49\,827\,365\,1 \\ 8\,194\,037\,65 \\ \hline 1\,864\,643\,894 \end{array}$$

(3.)

$$\begin{array}{ll} (m) & 215\,314\,043\,1213, \text{ \&c.} \\ (m) & 5042\,031\,425\,512, \text{ \&c.} \\ (m\text{-}1) & 43\,102\,310\,2413, \text{ \&c.} \\ (m\text{-}2) & 513\,421\,103\,21, \text{ \&c.} \\ (m\text{-}3) & 213\,042\,103\,2 \text{ \&c.} \\ (m\text{-}4) & 132\,021\,224 \text{ \&c.} \\ (m\text{-}5) & 132\,243\,15 \text{ \&c.} \\ \hline (m+1) & 1333\,321\,413\,412, \text{ \&c.} \end{array}$$

Sub-

Subtraction in this Arithmetick is reduced to Addition, by changing all the Signs of the Number to be ſubtracted.

Thus, if from (*n*) $7\bar{2}9\bar{3}8\bar{4}2\bar{9}6\bar{3}7$, &c. we are to ſubtract (*n*-2)$8\bar{1}0\bar{7}\bar{3}5\bar{9}2\bar{6}$, &c. the Remainder will be found as in Example 4.

(4.)

(*n*)	$7\bar{2}9\bar{3}8\bar{4}2\bar{9}6\bar{3}7$ &c.
(*n*-2)	$8\bar{1}0\bar{7}\bar{3}5\bar{9}2\bar{6}$ &c.
(*n*)	$7\bar{3}7\bar{4}7\bar{1}5\bar{4}3\bar{4}3$ &c.

Thus in all Caſes will Addition and Subtraction be eaſily performed: But the chief uſe of this Method will be, to eaſe the trouble of prolix Multiplications. And here, as well as in Diviſion, the firſt and moſt valuable Figures may be firſt found, and conſequently the Product may be continued to as many Places as ſhall be required, without finding any unneceſſary Figures; which is a convenience not to be had in the ordinary way of Multiplication.

Let it be propoſed to Multiply together the Numbers 860572939871 5 and 3891758364 38, which reduced to ſmall Figures will be $1\bar{1}4\bar{1}43\bar{1}40\bar{1}3\bar{1}5$ and $4\bar{1}\bar{1}2\ \bar{2}4\bar{2}44\bar{4}\bar{2}$. Write down theſe two Numbers one under the other upon a ſlip of Paper, with the Figures at equal diſtances, and then cut them aſunder. Take either of the Numbers for a Multiplier, and place it over the other in an inverted poſition, ſo as its firſt Figure

Figure may be juſt over the firſt Figure of the Multiplicand.

Moveable Multiplier
4 1 2 2 2 4 4 4 2

Multiplicand
1 1 4 1 4 3 3 1 4 0 1 3 1 5

4 5 6 1 7 9 1 8 2 5 4 9 8 6 4 5 0 6 2 6 0 6 0 8 0
1 1 1 1 3 1 1 2 4 2 6 3 2 1 2 3 1 1

Product = 4 6 5 0 8 6 1 9 3 7 0 9 6 0 1 7 0 7 2 6 2 3 1 7 0

Then Multiply theſe two firſt Figures together, and their Product ($4 \times 1 = 4$) place underneath. Then move your Multiplier a place forwarder, ſo that two of its firſt Figures may be over two of the firſt Figures of the Multiplicand; and collecting their two Products ($4 \times \bar{1} + \bar{1} \times 1 = \bar{5}$) put their Reſult underneath in the next place. Move the Multiplier a place forwarder; and collecting the three Products ($4 \times \bar{4} + \bar{1} \times \bar{1} + \bar{1} \times 1 = \bar{1}\,\bar{6}$) put the Reſult underneath, as in the Example. Move the Multiplier, and collect the four Products ($4 \times 1 + \bar{1} \times \bar{4} + \bar{1} \times \bar{1} + 2 \times 1 = 11$) which write underneath as before. And ſo proceed by one ſtop at a time, as long as any Figures of the Multiplier can be over any Figures of the Multiplicand. Laſtly collect the Product into one Line, which being reduced to a common Number will be 3349141936903996927377170.

From this Proceſs it may be obſerved, that at every new Situation of the moveable Multiplier thoſe Figures only are to be Multiply'd together, each by each, as are found over one another. And this Multipli-

tiplication is to be perform'd, and the ſeveral Products collected, according to the Rules of Specious Multiplication, wherein like Signs will make +, and unlike Signs will make — in the Product. This will always make the Products deſtroy one another, or at leaſt will depreſs and keep them low, and the Figures themſelves being always ſmall, the Reſult will be always ſmall, and often but a ſingle Figure, which is the great Compendium of this Method.

When an Approximation only is deſir'd, or when the Product is to be produced to a given Number of places, the Operation may be continued one place farther, in order to obtain ſo many Places true as are required. For ſeldom any Correction extends beyond the place immediately aforegoing, and that is generally corrected but by an unite, and very often needs no Correction at all; which will be of no ſmall convenience in the Multiplication of Decimal Fractions.

In this Method we may (if we pleaſe) begin the Proceſs of Multiplication from the loweſt places, or from the right hand, as is uſual in common Arithmetick, and then the Correction may be carry'd on continually to the next place, and ſo the Product may be always comprehended in one Line, without the uſe of any Superfluous Figures. Of this I ſhall give an inſtance in the foregoing Example.

Mo-

Moveable Multiplier
$\bar{4}\,1\,\bar{2}\,\bar{2}\,\bar{4}\,\bar{2}\,\bar{4}\,\bar{4}\,\bar{4}\,\bar{2}$

Multiplicand
$1\,1\,4^{1}\,4\,3\,3\,1\,4^{0}\,1\,3^{1}\,5$

$3\,3\,4^{9}\,1\,4^{1}\,9\,3\,6^{9}\,0\,3^{9}\,9\,6^{9}\,2^{7}\,3\,7^{7}\,1^{7}\,0 =$ *Product*

Place the moveable Multiplier inverted in such a manner, as that its last Figure $\bar{2}$ may be just over 5 the last Figure of the Multiplicand. Multiply these together ($\bar{2} \times 5 = \bar{10}$) and set down the last Figure of the Product 0 just under, reserving the first Figure $\bar{1}$ for the next place. Then move the Multiplier a place forwarder, so that two of its last Figures may be over two of the last Figures of the Multiplicand, and then Multiplying and collecting you will have $\bar{1} + \bar{2} \times 1 + 4 \times 5 = 17$. Set down 7 in the next place of the Product, and reserve 1. At the next remove you will have $1 + \bar{2} \times \bar{3} + 4 \times 1 + 4 \times 5 = 31$. Set down 1 and carry 3. Then $3 + \bar{2} \times \bar{1} + 4 \times \bar{3} + 4 \times 1 + \bar{4} \times 5 = \bar{2}\,\bar{3} = \bar{37}$. Set down 7 and carry $\bar{3}$. Then $\bar{3} + \bar{2} \times 0 + 4 \times \bar{7} + 4 \times \bar{3} + \bar{4} \times 1 + 4 \times 5 = \bar{3} = \bar{17}$. Set down 7 and carry $\bar{1}$. And so proceed as long as there can be any Figures over one another, and the Product will be found as before.

This way of Multiplication is so easy, and may be made so familiar by a little Practice; that it will be but little short of *Multiplication by Inspection*, and will doubtless seem very surprizing to those who are only acquainted with the common tedious way of Multiplication: especially if we content our selves with a mental preparation of the Numbers given, or only mark those Figures that are to be changed, which by some Practice is easily attained.

The

The first of these two ways of Multiplication will be most convenient for interminate Numbers. As if we were to multiply (m) 307149741748, &c. by (n) 183609712649, &c. the Product will be found (m + n) 563956758222, &c. as may appear from the Process following.

(n) 183609712649, &c.

(m) 307149741748, &c.

(m + n) 563956758222, &c.

Here the Index of the first Figure of the Product will be m + n, or the Sum of the Indexes of the given Numbers; but it would have been m + n + 1 if there had been any increase from the Product of the two first Figures, or if there had been any correction to have been made to the Cypher, which is understood before the first Figure of the Product.

When both the Numbers to be multiply'd are interminate, as in the last Example, they ought to consist of the same number of Places, or otherwise the greater number must be reduced to the lesser, by cutting off the superfluous Places: And the Product is not to be continued beyond the same number of Places. If but one of the number is interminate, the other must be reduc'd to the form of an interminate Number, either by cutting of the excess of places if it has more, or by supplying or supposing Cyphers, if it has fewer places than the interminate Number. Then the same restrictions will take place as before.

The Method of Division in this Arithmetick will not be so simple or expeditious as Multiplication. After a tryal of several ways, I think this following will be the most commodious. Reduce the Dividend and Divisor

to ſmall Figures, and form a Tariffa or Table of all the Multiples of the Diviſor as far as 5. Compare theſe Multiples with the Dividend, and with the ſeveral Remainders after the Multiples have been Subtracted, by which means you will diſcover the ſeveral ſmall Figures and their Signs, to be put ſucceſſively in the Quotient.

To form the Table of Multiples, ſet down the Diviſor above, drawing a line, under which ſet down the Diviſor over again, putting 1 over againſt it. Add theſe two together according to the Rule for Addition in ſmall Figures, and put 2 over againſt their Sum. Add this laſt and the Diviſor together, and put 3 over againſt their Sum. Then add this laſt and the Diviſor together, and put 4 over againſt their Sum. Laſtly, add this and the Diviſor together, putting 5 over againſt their Sum. Thus will you have a Table of all the Multiples of the Diviſor, as far as will be neceſſary.

Thus for Example, if (m + n) 563956758222, &c. = (m + n + 1) $1\bar{4}\bar{4}40\bar{4}32\bar{4}2222$, &c. is to be divided by (n) 183609712649, &c. = (n) $22\bar{4}\bar{4}.10\bar{3}13\bar{4}5\bar{1}$, &c. the Proceſs will be as here follows, by which the Quotient will be found (m) $31\bar{3}150\bar{3}42\bar{3}5\bar{4}$, &c. = (m) 307149741746, &c.

TABLE of Multiples.

	(n) $22\bar{4}4\bar{1}0\bar{3}1\bar{3}4\bar{5}1$, &c.
1	(n) $22\bar{4}4\bar{1}0\bar{3}1\bar{3}4\bar{5}1$, &c.
2	(n) $4\bar{3}\bar{3}22\bar{1}4\bar{2}53\bar{0}\bar{2}$, &c.
3	(n) $55\bar{1}23\bar{1}\bar{1}42\bar{1}5\bar{3}$, &c.
4	(n + 1) $1\bar{3}3444\bar{1}\bar{2}5\bar{1}4\bar{0}4$, &c.
5	(n + 1) $11\bar{2}\bar{2}05\bar{1}\bar{4}\bar{4}3245$, &c.

Quo-

Quotient = (*m*) 31315034235̄4, &c.

Dividend = (*m* + n + 1) 1444043242222, &c.
55123114215̄3, &c.

13132420335, &c.
2244103134̄5, &c.

15233451010, &c.
5512311421, &c.

3351404111, &c.
2244103133, &c.

1113313̄24, &c.
1122051̄44, &c.

1534220, &c.
55123̄1, &c.

12445̄1, &c.
133444, &c.

3205, &c.
3332, &c.

1533, &c.
551, &c.

124, &c.
112, &c.

12, &c.

The Index of the Quotient is found by ſubtracting the Index of the Diviſor from the Index of the Dividend, when the firſt Figure or Figures of the Diviſor are not greater than the like Figures of the Dividend. Thus $\frac{(m+n)\ 56,\ \&c.}{(n)\ 18,\ \&c.} = (m)\ 30, \&c.$ When they are greater, then an Unit muſt be farther Subtracted from the Index of the Dividend. Thus $\frac{(m+n+1)\bar{1}\bar{4}\bar{4},\ \&c.}{(n)\ \bar{2}\bar{2}\bar{4},\ \&c.} = (m)\ 3\bar{1}3,$ &c.

Now a little to illuſtrate this Proceſs, it may be obſerved, that the Dividend $\bar{1}\bar{4}\bar{4}$, &c. or 56, &c. being compared with the ſeveral Multiples of the Diviſor in the Table, it is eaſily perceived that 55, &c. makes the neareſt approach to it, and therefore its correſpending Figure 3 muſt be made the firſt Figure of the Quotient, which I place juſt over. Under this I place its reſpective Multiple, changing the Signs and collecting, becauſe it ought to be ſubtracted. Then the remainder 131, &c. being compared with the Table, I find the neareſt to it (whether in exceſs or defect) to be $2\bar{2}$, &c. or 18, &c. belonging to 1. This therefore is made the ſecond Figure of the Quotient, and its Multiple with the Signs changed is placed under, and collected with the laſt Remainder. The Reſult, or new Remainder $\bar{1}5\bar{2}$, &c. that is $-\ \bar{1}52$, &c. or $-\ 52$, &c. being compared with the Table, the neareſt Multiple is 55, &c. belonging to 3, which 3 therefore is made the next Figure of the Quotient, but with the Sign — over it, becauſe this Remainder is Negative. And for this reaſon the Multiple 55, &c. is put down in its place without changing its Signs. The reſt of the Proceſs will be obvious enough, and if any ſcruple ariſes about placing the Numbers, it may eaſily be removed

moved by a little attention to their reſpective Indexes.

In the Diviſion of interminate Numbers, the ſame reſtrictions are to obtain, as are already mention'd in Multiplication.

And this may ſuffice for a ſhort Summary of Negativo-affirmative Arithmetick, as to the ordinary Operations of Addition, Subtraction, Multiplication, and Diviſion. What improvements may be had from hence in the Extraction of Roots, whether of pure or affected Equations, I ſhall leave to future inquiry.

But all theſe Operations, whether in the common Decimal Arithmetick, or in this here compendiouſly deſcribed; and not only in Decimal Arithmetick, but in the ſeveral other Species, as Duodecimal, Sexageſimal, Centeſimal, *&c.* all theſe Operations (I ſay) may be much more eaſily and readily perform'd, and with equal accuracy, by an Inſtrument I have contrived call'd *Abacus*, or *the Counting-Table*, which I hope ſhortly to communicate to the inquiſitive in theſe matters, and by which all long Calculations may be very much facilitated. In the mean time this ſhort account of Negativo-affirmative Arithmetick, in Denary or Decimal Numbers, may be premis'd, by way of Introduction to the knowledge and uſe of the ſaid Inſtrument.

II. *Eclipſis Lunæ obſervata* Romæ, *ad radices Collis* Quirinalis, *nocte ſequente diem* 31. Octobris, 1724. *per clariſſimum Virum* Franciſcum Blanchinum. *Ex Epiſtola Rev. & Cl. Viri,* Johannis Baptiſtæ Carbone, *S. Jeſ. ad* Iſaacum Sequeyra Samuda, *M. D. R. S. S. Coll. Med. Lond. Lic.*

T. V. poſt Med. Noct.
H. M. S.

INitium umbræ veræ (quantum ſecerni poteſt à penumbra) apparere nunc incipit in limbo Lunæ, in ea parte diſci, quam ſecat radius à centro Lunæ ductus per maculam Ariſtarchi. 3 15 46

Cum nubes redderent difficiliorem conſpectum macularum, curavi definire quantitatem diametri obſcuratæ ope Micrometri. Nunc igitur latent Digiti 3. circiter. Nam portio diametri A B *Fig.* 1. ab umbra libera, eſt partium 14, qualium tota Lunæ diameter eſt 18 $\frac{1}{2}$. 3 32 40

Serenato tantiſper cœlo, umbræ limes tranſire videtur per Rheinoldum. Portio autem Diametri A B ab umbra non infecta eſt partium Micrometri 13. 3 39 40

Umbræ limes tanto ſpatio eſt infra Grimaldum (in tubo invertente objecta) quanta eſt diameter ejuſdem maculæ Grimaldi. Tranſit quoque limes umbræ per Eudoxum & Ariſtotelem. 3 50 40

AB

	H.	M.	S.
A B partes Micrometri 9.	3	54	40
Umbræ limes pervadit centrum Maris Criſium, & ſtringit limbum maculæ Grimaldi. Portio verò A B immunis ab umbra æquat partes Micrometri 8 $\frac{1}{2}$.	4	6	10
Sirius ad Meridianum appellit clariſſimè.	4	7	53
Totum Mare Criſium jam latere incipit, & in umbræ limite verſatur etiam centrum maculæ Grimaldi. A B eſt partium Micrometri 8.	4	12	40
A B partium Micrometri 7 $\frac{2}{3}$.	4	20	0
A B partium 7 $\frac{1}{4}$ circiter. Totus Grimaldus extra umbram, & Ricciolus quoque viſitur. Limes umbræ tranſit per marginem Maris Nectaris.	4	25	0
Detegitur Galilæus.	4	41	0
A B partes Micrometri 8.	4	52	0
Ariſtarchus incipit ex limite umbræ prodire.	4	55	30
Centrum Ariſtarchi exit.	4	56	30
Totus Ariſtarchus extra umbram.	4	57	30
Centrum Copernici exit.	4	59	20
Totus Copernicus extra umbram.	5	0	10
Eratoſthenes exit.	5	8	30
Helicon incipit emergere.	5	18	50
A B partes Micometri 12 $\frac{1}{3}$.	5	24	50
Plato incipit emergere.	5	25	50
Totus Plato extra umbram.	5	26	55
Plinius extra umbram.	5	28	20
A B partes Micrometri 14, vel 14 $\frac{1}{2}$. Quare digiti tres adhuc latent.	5	33	50
Prior limbus Maris Criſium incipit prodire.	5	38	50
Centrum Maris Criſium extra umbram.	5	40	50
Totum mare Criſium extra umbram.	5	44	50

Finis

	H. M. S.
Finis umbræ veræ, quæ exit è limbo Lunæ circa punctum definitum per Diametrum à centro ductam per Cleomedem.	5 48 50

III. *Obſervationes aliquot Circum-Jovialium habitæ eodem anno* 1724. *per eundem Cl.* Blanchinum. *Ex eadem Epiſtola.*

Dies.	*Menſ.*		*T.V. poſt Med.Noct.* H. M. S.
8	Jun.	IN Caſtro Viſcardi ſupra Vulſinium in eodem ferè Meridiano cum Vulſiniis (vulgò Bolſena) Satelles ſecundus B (*Vide Fig.* 2.) ex umbra Jovis emerſerat, & ita configuratus viſebatur cum cæteris.	2 48 30
		Satelles tertius C ſubit limbum Jovis è directo faſciæ mediæ.	3 0 30
		Satellitis intimi A incipit lumen imminui.	3 26 20
		Totalis ejuſdem immerſio, reliquis Satellitibus B, D, & faſciis perſpicuè apparentibus.	3 27 10
24	Jun.	Romæ obſervata eſt tum immerſio ſecundi Satellitis, tum primi, ita configuratis Jovialibus. (*Vide Fig.* 3)	
		Satellitis ſecundi B incipit lumen debilitari.	1 39 0
		Omnimoda ejuſdem immerſio.	1 40 20

Etiam

Dies. Menſ.		T.V. poſt. Med. Noct. H. M. S.
	Etiam Satellitis primi A lumen imminui jam incipit.	1 41 50
	Lux ejuſdem omninò diſparet, cæterorum lumine, & faſciarum adſpectu nitidiſſimè perſeverante.	1 42 50
Kal. Jul.	Illuceſcente Aurora, Romæ immerſio totalis intimi Satellitis Jovis clariſſimè ſpectata eſt; cum ante minuta ſecunda horaria 55″ circiter, lumen ejuſdem cœperit debilitari, cæteris Satellitibus & faſciis perſpicuè apparentibus, cœlo clariſſimo.	3 24 29
		T.V. poſt Merid.
18. *Aug.*	Romæ intimus Jovis Satelles ex umbra cœpit emergere, & pleniſſimè lucebat in A, inter limbum Jovis, & ſecundum Satellitem B, (*Vide Fig.* 4.) qui a limbo Jovis diſtabat ſemidiametro circiter Jovialis diſci. Satelles A emerſit ab umbra inter duas faſcias corporis Jovialis inferiores, ſitu everſo in Teleſcopio.	0 40 45
	Obſervatio fuit clariſſima & diligentiſſima, cœlo clariſſimo.	0 41 25
		T.V. poſt Merid.
25. *Sept.*	Romæ, intimi Jovis Satellitis initium Emerſionis.	11 25 55
	Totalis recuperatio luminis.	11 27 5

Dies. Menſ.		*Temp. V. poſt Merid.*
		H. M. S.
11. *Octob.*	Albani, ejuſdem intimi Satellitis initium Emerſionis.	9 53 8

Ex pluribus obſervationibus Romæ habitis, & Ulyſſipone, eruitur Meridianorum differentia 1 h. 28′ 0″, ſeu Grad. 22, quæ ſanè differentia aut omninò vera, aut quam proximè veritati accedere videtur.

IV. *Obſervatio Lunaris Eclipſeos* Albani *habita poſt Occaſum Solis diei Dominicæ* 21 Octobris. *S. N.* 1725. *Ab eodem. Ex eadem Epiſtola.*

H. M. S.

HOrologiis pendulo inſtructis, & per dies plures ad meridiem verum exactis utebamur.

Occaſum ſolis ſpectare hodie non licuit, nubibus occupantibus occidentalem Horizontis plagam.

Nubibus pariter orientalem tractum obſcurantibus in Lunæ ingreſſu in umbram, tam pertinaciter auſtralis ventus novas cogebat, ut per totum tempus immerſionis integri globi Lunaris in umbram, vix ter, aut quater, idque raptim, tubum opticum in eum dirigere datum ſit.

Circa hoc tempus umbra videbatur ad centrum Lunæ pertingere. Sed cum maculæ diſtinctè definiri non potuerint breviſſimo illo ſpatio temporis, quo per nubium intervalla diſcus Lunaris detegebatur, præcisè noſcere non valemus hanc ipſam phaſin digitorum ſex Lunaris diametri obtectorum, licet paulò abludat à minuto 15, poſt horam ſextam à Meridie. 6 15 0

Totalis Immerſio ad hoc circiter minutum temporis referenda eſt, quantum ſpectare licuit ex duobus, aut tribus minutis horariis, quibus Lunam vidimus ſatis di- 6 45 0

	H.	M.	S.
ſtinctè. Verùm ſecunda temporis definire, quibus umbra vera totum diſcum obtinuit, permiſſum nobis non fuit à nubibus ſuccedentibus.			
Poſt immerſionem totalem diſcus Lunæ apparebat ab Atmoſphæræ terreſtris radiis refractis rubeſcens, dilutiori tamen colore in ea parte limbi, quam poſtremam Sol deſeruerat.			
Inducta poſtmodum ſerenitate, licuit obſervationes emerſionis perficere.			
Subalbicat diſcus Lunæ in limbo proximè illuminando. Nondum tamen lux directa Solis diſcum attingit.	8	20	0
Clarior adhuc fit limbus Lunæ; ſed nondum excedit ab umbra vera.	8	25	0
Nunc primùm limbus Lunæ incipit lumen recuperare in parte circumferentiæ ſita inter maculas Grimaldi & Galilæi: quæ maculæ adhuc latent.	8	27	0
Limes illuminationis attingit primum limbum Grimaldi.	8	29	40
Totus Grimaldus extra umbram.	8	30	40
Galilæus emergit ex umbra.	8	31	30
Ariſtarchus incipit emergere.	8	35	40
Totus Ariſtarchus emerſit.	8	36	0
Prior Copernici limbus incipit illuminari.	8	48	20
Totus Copernicus extra umbram.	8	49	50
Totus Plato emerſit.	8	51	20
Prior limbus Tychonis incipit emergere.	8	54	0
Totus Tycho extra umbram.	8	56	0
Subtenſa arcus C A D, & C F D per Micrometrum explorata eſt partium Micrometri 22, qualium Lunæ diameter eſt 24 in	8	59	0

tubo

	H.	M.	S.
tubo palmorum undecim Rom. A B verò eſt partium 12. (*Vide Fig.* 5.)			
Menelaus 25 exit. (25 eſt numerus maculæ aſſignatus in Lunæ imagine, à Pariſienſi Academia edita.)	9	2	0
Macula clarior ſita ante Plinium exit.	9	5	0
Hermes ab umbra prodit.	9	6	0
Plinius emergit.	9	50	0
Incipit emergere Poſſidonius 27.	9	16	0
Maris Criſium limbus prior emergit.	9	18	0
Totum Mare Criſium extra umbram.	9	25	0
Langrenus 39 exit.	9	24	0
Umbræ extremum in limbo Lunæ adhuc videtur.	9	24	30
Finis umbræ veræ.	9	25	0

V. *Conſpectus Maculæ Platonis in Luna cœlo clariſſimo nocte ſequente diem* 16 Auguſti 1725, *hora prima poſt occaſum Solis* Romæ *in monte* Palatino, *per tubum opticum* Joſephi Campani, *palmorum* 150 Romanorum, *ſpectante eodem Viro Cl. Ex eadem Epiſtola.*

MArgines elevati in ambitu maculæ perfundebantur luce Solis, & candorem conſuetum oſtendebant: fundus maculæ tenebroſus ſpectabatur, cum ad illum radii ſolares nondum pertingerent. Sed projectio lucis minus candidæ, imò nonnihil rubeſcentis, pervadebat mediam aream maculæ (ut in *Fig.* 6.) non ſecus, ac ſi in latere marginis A Soli obverſo foramen aliquod fuerit, per quod radius Solis admitteretur.

Cla-

Clariſſimus hic Vir in ſua, quam ad me ſcripſit, epiſtola, ratiocinari ſuper hoc maculæ conſpectu nonnihil voluit, ſuamque de ea re mentem exponere. Duplicem verò innuit cauſam, unde prædictus effectus procedere poſſet; vel ſcilicet foramen in latere marginis Soli obverſo; vel refractionem alicujus radii ſolaris in ſummitate marginis factam, unde interiores partes ipſius maculæ pervaderet radius. Utrumque ſanè probabile, & utrumque pariter confirmat, dari circa Lunam Atmoſphæram noſtræ non abſimilem, ut & ipſe Auctor infert; ſive enim foramen admittamus, per quod Solis radius introducatur, & hîc ſane neutiquam videri poſſet in obſcuro cavo maculæ, niſi ab exhalationibus lucem reflectentibus fieret conſpicuus; vel admittamus refractionem, & hæc ſine intermedio craſſiori dari nequit. Hæc addere volui, ut ratio innoteſceret, quæ laudatiſſimum Virum adduxit ad hujus maculæ obſervationem accuratè deſcribendam.

VI. *A Remark upon the New Opinion relating to the Forces of moving Bodies, in the caſe of the Colliſion of* Non-Elaſtic Bodies. *By Mr.* John Eames, *F. R. S.*

1. THE antient Opinion, and moſt generally entertained, is, that the Forces of Bodies in Motion are as their Quantities of Motion, *i. e.* as their Quantities of Matter multiplied by their reſpective Celerities.

2. The new Opinion is, that the Forces of Bodies in Motion are as their Quantities of Matter multiplied by the Squares of the Velocities; ſo that in equal Maſſes the moving Forces will not be as the Velocities themſelves, but as their Squares.

3. Hence it follows, that a Body moving with five Degrees of Velocity, moves with five and twenty Times more Force, than when it moves but with one Degree; whereas according to the common Opinion, it has but five times as much, *i. e.* proportional to its Velocity.

4. The lateſt Experiments brought to prove the truth of the new Opinion are made upon ſoft, or yielding Subſtances. Now theſe have been already obſerved to be a little complicated, and improper for this Purpoſe. The proper Uſe of Experiments of this kind being rather to diſcover, and ſettle the Laws, which ſuch kind of Subſtances obſerve in the Reſiſtance they make to Bodies moving in them, than the Forces themſelves, with which the Bodies move, which ought to be determined before hand by ſome ſimple Experiment, fit to determine that Matter.

5. A variety of Experiments have been made, and reaſoning uſed in *England* and *France*, to prove the Truth of the common Opinion; but they do not entirely ſatisfie all the Gentlemen on the other ſide of the Queſtion. The preſent ingenious Profeſſor of Mathematicks and Philoſophy at *Utrecht* tells us in the Preface to his *Epitome Elementorum Phyſico-Mathematicorum*, publiſh'd this Year, *Anno* 1726, *In corporum motorum viribus ſupputandis amplexus ſum ſententiam Cl.* Leibnitſii, Hugenii, Poleni, S. Graveſandii, *& antiquæ valedixi, quam hactenus foveram, & docueram: Neque me retinuerunt argumenta doctiſſimorum virorum in* Galliis & Britannia *eandem defendentium.*

Et quando experimenta à Poleno & 'S Graveſandio *deſcripta examinantur & inſpiciuntur, tam manifeſto evincunt vires corporum percutientium eſſe in ratione compoſita ex quadrata velocitatum, & ſimplici maſſarum, ut illis ſubſcribere teneamur, niſi apertiſſimis contradicere ſtudeamus.*

6. I beg leave to examine the truth of the new Opinion in the Caſe here propoſed, *viz. Vires corporum percutientium*; and I ſhall endeavour to ſhew from their own Principles, that it cannot be true in all the Caſes of Non Elaſtic Bodies.

7. 'Tis allow'd, that the common Rules of finding the Velocities of Non-Elaſtic Bodies after the Stroke are true: For thus the ingenious Mr. *S. Graveſand* tells us in Paragraph 251, of his *Supplementum Phyſicum*; *Ex hoc principio* (i.e. *multiplicando maſſam per velocitatem*) *deduxêre Philoſophi ipſas illas regulas* n. 234. *ſ.* 237. *ſ. quas nos variis modis ex principiis noſtris deduximus; mirum hîc quid contigit, error erroris fuit deſtructio, & duplex error ad veritatem conduxit; falſum de menſura virium ſecuti ſunt principium, & quod veritati etiam minimè congruum eſt, nullam vim intro premendo*

partes

partes, & harum ſuperando cohæſionem corpora amittere poſſuere.

8. Now the Rule for finding the common Velocity of Non-Elaſtic Bodies moving the ſame way after the Colliſion, is, to divide the Sum of the Quantities of Motion in the two Bodies, by the Sum of the Quantity of Matter.

9. 'Tis alſo granted, *Motu duobus corporibus communi corpora hæc in ſe mutuo agere non poſſe.* In Sect. 215. *Supplement. Phyſ.*

10. *Pendet ergo ictus à velocitate reſpectiva, qua manente intenſitas impactionis eadem erit, quomodocunque celeritates abſolutæ varient.*

11. *Ab intenſitate hac pendet partium introceſſio, quæ ergo ſemper eadem erit. ſi duo corpora eadem velocitate reſpectiva in ſe mutuo incurrunt, quibuſcunque velocitatibus moveantur.*

12. Theſe Principles furniſh us with an Argument againſt the new Opinion. For if it be true, then equal Cauſes may have unequal Effects, and that in their own ſenſe of an Effect: The Proof ſhall be taken from Inſtances of the Effects of the Colliſion of Non-Elaſtic Bodies, whoſe reſpective Velocities ſhall be always equal.

13. Let (A) and (B) ſtand for two Non-Elaſtic Bodies of equal Quantities of Matter; and let (B) be at reſt, while (A) moves towards it with 8 degrees of Velocity.

1. Here the common Velocity after the Stroke will be half the Velocity of (A) before the Stroke, *i.e.* 4 degrees. Conſequently the force in (B) thus communicated by the Stroke will be as its Square, or 16.

2. Let (B) move forward with two degrees of Velocity, and (A) follow it with 10 degrees; the reſpective Velocity will be 8 as before; conſequently by Paragraph 10th of this Paper, the Strokes in both caſes are equal. The Velocity in (B) after the Stroke will be half the Sum of the Velocities before the Stroke, or 6 degrees, by Paragraph 8th.

According to the new Opinion, the Forces being as the Squares of the Velocities, the Force of (B) before the Stroke will be to its Force after the Stroke, as the Square of 2 is to the Square of 6; *i. e.* as 4 is to 36. Subduct the Force in (B) before the Stroke, from the Force it has after the Stroke, and you have the Degrees of Force communicated by the Stroke: Which, if this Opinion were true, would be 32, *i. e* juſt double the Number of Degrees communicated by the ſame Force in the former Inſtance, which was but as 16. Thus equal Strokes produce unequal Effects in our ſenſe of Effects.

14. The following Table gives ſeveral other Inſtances. In the three firſt Columns you have the Velocities of the two Bodies both before, and after the Stroke; in the two next, you have the Forces in (B) both before, and after the Stroke; and in the ſixth, the Difference of thoſe Forces, or the different Degrees of Force effected by the ſame Stroke; and in the laſt Column, the Proportion of thoſe Forces, or Effects of the Cauſe or Stroke.

The Velocity in			The Forces in B.		Force communicated by the Stroke.	Proportion.
A	B	B				
8	0	4	0	16	16	1
10	2	6	4	36	32	2
14	6	10	36	100	64	4
18	10	14	100	196	96	6
22	14	18	196	324	128	8
26	18	22	324	484	160	10
	Before	After	Before	After		
	the Stroke.		the Stroke.			

15. If it be ſaid, that I have not conſider'd the other part of the entire Effect of the Stroke, the Intropreſſion of the Parts; I reply, this will make but a ſmall Alteration in the matter; ſince the Intropreſſions in all theſe Caſes are equal, (Paragr. 11.) the relative Velocities being by ſuppoſition the ſame: So that notwithſtanding, upon the whole, one and the ſame, or equal Cauſes, will produce unequal Effects.

VII. *Remarks upon a ſuppoſed Demonſtration, that the moving Forces of the ſame Body are not as the Velocities, but as the Squares of the Velocities. By the ſame.*

THE Demonſtration runs thus: "Concipio cor-
" pus C *Fig.* 7. moveri obliquè in elaſtrum L, ve-
" locitate C L ut 2, angulo inclinationis C L P exiſtente
" 30 gr. cujus nempe ſinus C P eſt ſemiſſis radii C L.
" Suppono autem eam eſſe reſiſtentiam in elaſtro, ut
" ad illud tendendum requiratur præcisè unus velocita-
" tis gradus in illo corpore, ſi perpendiculariter im-
" pingeret. Quid ergo jam fiet poſt incurſionem ob-
" liquam corporis C in elaſtrum L? Quoniam motus
" per C L componitur, ut notum eſt, ex duobus colla-
" teralibus per C P & P L, & cum C P, ſecundum
" quam corpus directè impingit in elaſtrum L, expri-
" mit dimidiam celeritatem corporis per C L, conſume-
" tur hic motus per C P, tenſo elaſtro (perinde enim eſ-
" ſet, ac ſi corpus C celeritate C P perpendiculariter
" incurreret in elaſtrum, quod per Hypotheſin, eam
" celeritatem deſtruere poſſet) remanente corporis ce-
" leritate, & directione P L. Producta igitur P L in
" M, ita ut L M ſit = P L = $\surd$3 (ponitur enim C L
" = 2) & applicato in M alio ſimili elaſtro faciente
" cum L M angulum L M Q, cujus ſinus L Q = C P =
" 1, per eandem rationem manifeſtum eſt corpus C,
" poſt tenſionem elaſtri L, tenſurum eſſe elaſtrum M,
" amiſſo motu per L Q, & ſervato motu per Q M.
" Prolongata itaque Q M ad N, ut fiat M N = Q M
=

" $= \sqrt{2}$ ibique ſubſtituto elaſtro ſimili tertio conſtitu-
" ente cum MN angulum MNR ſemirectum, quo
" ſcilicet MR iterum ſit $= CP = 1$; patet ſimiliter
" motum per MR totum impendi in tenſionem elaſtri
" N, corpore interim moveri pergente directione &
" celeritate RN = 1. Denique ſi hac celeritate reſidua
" impingat perpendiculariter in elaſtrum O, huic ten-
" dendo totam ſuam vim reliquam dabit; ipſum ita-
" que corpus ad quietem redigetur. Hiſce ita præ-
" miſſis, patet nunc potentiam corporis C tantam fu-
" iſſe, ut per ſe ſolum tendere poſſit præcisè quatuor e-
" laſtra talia, ad quæ ſingula ſeorſim tendenda requi-
" ritur dimidia velocitas corporis æqualis ipſi C, ade-
" óque cum effectus illius quadruplo major ſit quàm
" effectus hujus, evidens eſt quoque vim corporis velo-
" citate 2 grad. quadruplam eſſe vis corporis ejuſdem,
" vel æqualis, velocitate 1 grad.

" Haud abſimili modo demonſtrarem corpus C ve-
" locitate 3 grad. tendere poſſe 9 elaſtra, ad quorum u-
" num tendendum unus velocitatis gradus in eo cor-
" pore requiritur, & tandem in genere numerum ela-
" ſtrorum tenſorum ſemper eſſe quadratum numeri
" graduum velocitatis. Unde igitur ſequetur, vires
" corporum æqualium eſſe in duplicata ratione celeri-
" tatum. Q.E.D.

1. This Argument is founded entirely on the commonly received Doctrine of the Compoſition and Reſolution of Forces, and not upon any deciſive Experiments, that have been actually made upon this occaſion.

2. All that is proved from this Doctrine, is, that a Body moving with two Degrees of Velocity, may be made to bend 4; with 3 Degrees of Velocity it may be made to bend 9 ſimilar Springs, each deſtroying one Degree

Degree of Velocity in a perpendicular Direction, before its force is entirely ſpent, provided you take care to alter the Directions of the Motion in every Stroke but the laſt, after a certain manner: That had the ſame Body moved but with one degree of Velocity in one Direction, and that in a perpendicular one, it would have loſt all its force at once, and bent but one of thoſe Springs: Which is far from proving the thing in Queſtion.

3. To make the Reaſoning on this Head concluſive, the two Bodies ſhould not only be equal in Quantity of Matter, but alike in that material Circumſtance the Direction of their Motions; ſo that if one of the Bodies move in a perpendicular Direction, the other ſhould do ſo too; or if the one ſtrikes in an oblique Direction, the other ſhould do the ſame, and that in the ſame degree of Obliquity; and laſtly, if one moves in ſeveral Directions, the other ſhould do the ſame. But in the caſe before us one is ſuppoſed to move but in one Direction perpendicularly, and the other to move in three oblique Directions, and but one perpendicular.

4. Let therefore the ſame Body move always in the ſame Directions, and with a ſmall Alteration, the Argument uſed in this Demonſtration will be ſo far from proving that ſide only of the Queſtion for which it was brought, that it will equally ſerve to prove the truth of the other, namely, that the Forces of the ſame Body moving with different Velocities are as thoſe Velocities.

Let therefore the ſame Body, inſtead of moving with two Degrees of Velocity, move but with one, and in the ſame Directions as above; only let the Springs be capable of deſtroying but half a Degree of Velocity in a perpendicular Direction; then by the ſame ſteps of

of reaſoning it will follow, that this Body will now alſo bend 4 ſimilar Springs, before its Force is ſpent; ſo that the ſame Body moving with half the Velocities, and in the ſame Directions as before, bends the ſame number of Springs; only now the Springs make but half the Reſiſtance, that the Springs in the former caſe made; therefore the Effect in this caſe, according to our way of eſtimating an Effect, is but half the former Effect; conſequently the Forces producing theſe Effects are as 2 to 1; But in this *Ratio* are the Velocities, with which the Body moved in the two Caſes; therefore the Forces are as the Velocities.

Let the Body move with 3 degrees of Velocity, and it will bend 9 ſimilar Springs, each deſtroying one Degree of Velocity in a perpendicular Direction, before the whole Force is conſumed. So alſo by the ſame way of arguing, 'tis as certain, that if the ſame Body move with one degree of Velocity, it will bend 9 ſimilar Springs, each deſtroying a third part of one Degree of Velocity in a perpendicular Direction, before its Force is extinguiſhed: So that ſtill the Effects, or Reſiſtances overcome in the ſame Directions, are, according to our way of computing, as 3 to 1; and ſo alſo their Forces muſt be but in the ſame *Ratio* of 3 to 1, as were the Velocities; conſequently the Forces are as the Velocities.

5. Since therefore this Proof drawn from the Doctrine of Compoſition and Reſolution of Forces equally proves both ſides of the Queſtion, it proves too much, or in reality nothing at all; and is therefore far from deſerving the Name of a Demonſtration.

VIII. *Brevis Commentatio de Cobalto, Auctore Viro Clariſſimo,* Joh. Henr. Linckio, Lipſienſi, *Acad.* Cæſar. Leopold. Carolin. *Nat. Curioſ. & Soc. Reg.* Anglic. *Sodale.*

INter plurima Mineralium genera, vix datur aliud, quod tanta nominum farragine, æquivocatione, & confuſione intricatum, tam operosâ explicatione indigeat quam Cobaltum. Veteres de Cadmia & Marcaſita quædam, quaſi edentuli, murmurant; poſterioris ævi Viri de Auripigmento, Sandaraca, Tutia, Spodio, Pompholyge huc miſcuerunt ſermones; tandem Lapide calaminari, Zinco, Cobalto, auribus obſtrepitum noſtris eſt; & ſub Cobalto denique ſunt, qui jam vaporem metallicum, jam pygmæum ſubterraneum ſubintelligunt. Quanqnam enim ejuſmodi tituli res innuant conſanguinitate pariter & uſu non parum conjunctas; ſubjectis tamen & characteribus fere omnes, & uſibus deſtinatis non paucas ab invicem differre, maxime tenendum eſt. Jam quidem de eo ſaltem, quod hodie, noſtris inprimis, Cobaltum appellatur, agere apud animum meum propoſui, atque dicam, ſi non plene, plane tamen, quod res ipſa ſit, non curatis denique de verbis, quæ moveri poſſent, diſputationibus. Cum vero periculum ſit, ut omnes, imprimis per libros, & ſine igne Philoſophi, omnia, uti decet, intelligant, atque evolvendo naturalium rerum homonymias, ac titulorum ſignificatus proprios, analogos, æquivocoſque, non parum lucis adferamus legentibus, non ſuperfluum fore duxi, de illis quædam præmittere.

Cad-

Cadmia, Καδμεία, ut antiquiſſimum, ita obſcuriſſimum nomen Græcorum eſt, propriè Thebarum arcem, Cadmeam, à Cadmo, Agenoris filio, in Bœotiâ conditam; impropriè verò jam Lapidis Philoſophorum materiam, vel ſi velis, illum ipſum ſignificans; (unde adopturientes, vel adepti, ſocii Cadmi audiunt, h. e. viri, quibus arcem naturæ, plurimis inexpugnabilem, occupare contigit) jam mineram aliam, qualis Lapis Calaminaris eſt; jam ſublimatum quoddam in tingendo ad flavum cupro cum iſto lapide coincidens, denotat; unde Cadmia foſſilis, Cadmia fornacum, Cadmia metallica; porrò Cadmia atramentoſa, *i. e.* ea, quæ vel per ſe atramentum, ſeu vitriolum, qualis Lapis Calaminaris eſt, vel ex accidenti, *h. e.* ab admixta minera pyritoſa exporrigit. Quod ſi igitur à quopiam Cobaltum hodiernum Cadmiam appellatum audiveris, vel ab ipſo ita appellari alicui libuerit, faciat; evitet modo incongruam vocis acceptionem. Quod tutius fieri non poterit, quam ſi pronunciaverit nomen cum addito, Cadmia pro Cœruleo, de qua hic ſermo eſt. Marcaſita, originis Arabicæ vocabulum,

I. Apud Metallicos denotat pyritam ſubflavum, angularem, in ſpecie hexaedron, ſeu cubicum, politum, cæterùm ab alio, quoad eſſentiam & cætera planè non differentem, atque ita potiſſimum ſulphur & ferrum, adhæc fortè cupri arſenicique particulam ſæpe continentem; auri itaque ac ejuſmodi ſpecioſos titulos promerentem minime;

II. Apud Mercatores, quos Materialiſtas vocant, pariter & apud Pharmacopolas famoſum illud ſemimetallum, Biſmuthum;

III. Apud Alchymiſtas, vel materiam primam, vel ſecundam, mineralem, crudam aliquam, eamque ſemimetallicam ſeu mercurialem, qualis dictum Biſmuthum, regulus ♁, Zincum & o=o inprimis ſunt. Qua-

tenus igitur non modo arſenicum Cobalti, ſtrictè ſic dicti, pars eſſentialis eſt, ſed & Biſmuthi minera cum dicto Cobalto intimæ cognationis vinculo tenetur, atque illud, idque verè egregius cœruleum, quam Cobaltum, fiſtit vitrum, eatenus Marcaſitæ appellatio hic locum aliquem invenit; dummodo evitetur falſa vocis acceptio, ac intelligatur, eam anguſtam nimis & adæquatam minus eſſe, nempe Cobaltum plus quam Marcaſitam, *h. e.* non ſolùm ſubſtantiam ſemimetallicam illam, Biſmuthum, & aliam ſcilicet arſenicalem, ſed etiam terram in cœruleum vitreſcibilem, in ſe comprehendere.

Auripigmentum noſtris equidem temporibus nihil aliud eſt, quàm minera illa lutea foliacea, arſenicali-ſulphurea, *Operment.* Sunt verò, qui latiori illud acceperunt, *h. e.* non ſolùm materiali, ſed etiam effectivo ſignificatu. Neque hoc quidem ſine omni cauſa. Auripigmentum enim, præterquam quod aureum præ ſe ferat, picturiſque inferat colorem, & in habitu ad metalla ejuſmodi ſubjectum non incongruè denotat, quod colore luteo cuprum imbuit, quale inprimis Zincum, Cadmia fornacum, Cobalti non diſſita agnata ſunt. Ubi verò negari non poteſt, Cobaltum noſtrum neque ratione partis volatilis, ſemimetallico-arſenicalis, ex qua ad cuprum dealbationis potiùs gaudet energia; neque ex cauſa terræ vitreſcibilis hunc in finem ullatenus convenire. Ab arſenico tamen, ſive album, ſive flavum, ſive rubrum ſeu Sandaraca, eaque tam foſſilis, quam factitia ſit, non rarò cognominatur id, quod à Cobalto rectius fieret; dicentibus noſtris Freibergenſibus, tam metallicis, *v. g.* hanc vel illam mineram Cobalticam eſſe, ſeu *Kobold*, quam fuſoribus, quando jam fumos, jam quædam in furnis & toſtrinis ſublimata appellitant cobaltica, & nobili metallo deletoria:

(*Cobal-*

(*Cobaldiſch und rauberiſch :*) Atque hoc Cobaltum putatitium non niſi pyrites ſulphureo-arſenicalis ibi eſt, quum tamen verum ab omni ſulphure planè liberum ſit, & pyrites talis terra pro cœruleo penitus deſtituatur. Quin Freibergæ Cobaltum ferè incognitum, minimum reperiendum verum vix eſt, ſed Schneebergenſium & Annæbergenſium fines adeundi. Proinde male conſules receptis & laboribus tuis, ſi Cobaltum promiſcuè expetieris, hanc vel illam abuſivam vocis acceptionem, quæ ſingulis interdum ſemimilliaribus alia deprehenditur, non cogniturus.

De vapore metallico & Pygmæo non eſt, ut pro avertenda æquivocatione hic adeo ſimus ſolliciti ; ſunt tamen ſumicapii & ventivenduli, qui in ejuſmodi materia vaporoſa ſemen metallorum, materiam & mercurium Philoſophorum quærendum volunt : & nota metallicorum hic dictio eſt: *Der Schwaden, der Kobold ſey aufgeſtiegen, wovon man habe aufreiſſen müſſen, auch mancher Bergmannerſtioket worden*; i. e. Cobaltum ſeu vaporem metallicum aſcendiſſe, & hunc operarium ſuffocaſſe. Quem dicendi morem credo matrem iſtius opinionis maximam partem eſſe, qua creaturæ animatæ ſubterraneæ, *Erd-und Berg-geiſter, kleine Koboldgen* finguntur. Squidem verba, prout jacent, non aliter ſonant, ac ſi agens quoddam intellectuale ſuffocationem & mortem hominis intenderit, & manibus quaſi perpetraverit. Non aliter atque cum Paracelſi ſpiritibus, homunculis cucurbitalibus, atque ejuſmodi phænomenis, ſuo tempore ſtupendis, comparatum ſuiſſe puto, quando jam album, jam rubrum, jam viridem ſpiritum ex Endore ſuo, *h. e.* per alembicum, aſcendere & provenire ait, atque adhuc tyrones noſtri ſine omni incantatione producere non neſciunt.

Ex omibus hiſce Cobalti & Cadmiæ nomina ad rem præſentem conveniunt, & ſi hæc rectè conſideretur, pro Synonymis haberi debent. Quoniam autem Cadmiæ vocabulum apud ſcriptores plurimis laborat dubiis, hoc miſſo, Cobalti titulum ſervamus, vocabularium metallicorum ſequentes, quicquid ſcholaſticorum turba contra literarum barbariem obganniat. Cæterùm de hiſce nominibus & rebus meretur conferri Henkelii, qui Freibergæ in Hermunduris metalli feraciſſimæ, ut & agrorum & metallifodinarum adjacentium Phyſicus eſt experientiâ celebris, & ſocietatis Berolin. Membrum eſt, *Pyritologia*, cap. 2. Cobaltum igitur eſt minera griſea, obſcurè albicans, mineræ argenti albæ, & pyritæ albi, quoad colorem æmula, ſed paulò obſcurior, continens arſenicum album & terram fixam, cum ſilice & cineribus clavellatis in vitrum cœruleum abiens.

Effoditur in Schneebergenſium & Annæbergenſium terris, inprimis in Cervi, Rappolti, centum millia equitum, Galilææ, & quotquot ſunt, puteis; & quidem in venis propriis, idque ita purum putumque cum duriſſimo ſilice, ſeu, quod vocant quarzo, ut, ſi quæ fortè alia minerarum genera interſperſa ſeu adfixa alicubi reperiantur, non ſimul cum vera Cobalti ſubſtantia, ſilici dicto innata, ſed aliis ex cauſis, imo aliis venis aſſociata non obſcurè appareant.

Signorum externorum ejus proximum & indubium eſt minera quædam roſei coloris, ſtructuræ radiatæ, quam Cobalti florem, *Cobald-Blüthe* vocant; inter egregia & ſpectatu digna in minerarum gazophylaceis recondita. Hujus operis datur & alia, coloris verò non adeo roſei nitidi, ſed pallidioris, nulliuſque ſtructuræ, ſed pulveris inſtar mineram ambientis.

Signum

Signum propius præbet accurata ocularis collatio mineræ hujus cum pyrita albo; accuratior cum minera cupri griſea; accuratiſſima cum minera argenti alba; cum quibus rebus intereſt ipſi non levis coloris ſimilitudo, eſſentiæ maxima differentia; quod verò verbis nec exprimi, nec concipi ſatis poteſt, ita, ut frequentî opus ſit intuitu. Vid. laudata *Pyritologia*, p. 193, ſq.

Signum proximum, ſeu res ipſa manifeſtatur ex vitro inde confecto, quod ex pyrita nigrum, ex dicta cupri minera rufum, ex argenti alba, & cupri participe minera, jam magis minuſque nigricans; ex Cobalto vero ſapphirinum prodit, unde & Zaffera, tum pro Cobalto toſto, tum etiam pro vitro cœruleo in pulverem redacto, nomen ortum, veroſimile eſt.

I. Per ſe Cobaltum auræ, pluviæ, ſoli in cumulo diu expoſitum efflorescit roſei vel perſici coloris, qui dicitur, flos Cadmiæ, ſed cum illo flore nitidiori antea deſcripto, non confundendus. Ille ritè extractus; reddit ſubſtantiam elegantiſſime rubram, & ad hæe vitrioli obſcurè viridis portiunculam, quæ merentur ulteriorem inveſtigationem; mineræ autem non parvam quantitatem, tempus & aſſiduitatem & patientiam requirunt, cujus rei encheireſes noſter laudatas D. Henkel compertas probe habet.

II. Spiritus Nitri ſolvit illud cum impetu & effervescentia, *v.g.* vi. vel iv. partes ad unam, quatenus minera pura vel minus eſt; unde verò reſultare ſolet ſolutio non unius coloris. Viridis nempe color Vitrioli Veneris prope eſt, ſi cuprum certè continet; quod apparet in illa Cobalti minera, quæ *Kupfer-Nikel* appellatur, & adhuc cruda cupreum colorem præ ſe fert. Viridis tamen etiam provenit aliquando ex ea minera, quæ tota griſea, & nullatenus ad viſum cuprea, quam-

vis

vis ad colorem ſolutionis Vitrioli Martis puri accedens; tamen à cupri contactu non planè aliena. Obſcurè flaveſcentem ſolutionem reperio optimam ad vitrum illud ſiſtendum cœruleum. Rubicunda implicatam ſibi ſignificat mineram Biſmuthi.

III. Solutiones, cum Alcali, *v. g.* oleo tartari per deliquium præcipitatæ reddunt pulverem porcellanæ debitè applicatum, egregiè cœruleum, ſi contigit, cætera paria, inprimis Cobaltum ſelectiſſimum, atque ignis te eſſe expertum directorem.

IV. Acidum Vitrioli & Salis communis adoriuntur quidem Cadmiam noſtram, ſed non tam ſolvunt, quam erodunt, inprimis Vitrioli acidum, & in pulverem album reducunt, adeò ut ſpiritus Nitri convenientior ſit ſolvendæ Cadmiæ.

V. In vaſe clauſo, retorta lapidea loricata, vel ſublimatorio alio, igne aperto debitè detentum effumare patitur partem volatilem arſenicalem, ab initio aliquantulum fuliginoſam, imo & ſandaraceam, atque ita ſulphuris communis non planè expertem, quam maximè autem ſe colligentem in forma ſemimetallica ſplendida, regulina, foliata, qualis ex pyrite albo provenit, ubi verò ſplendor per dies, imo per horas evaneſcit, luculento indicio, particulas aërias in ſubſtantiam illam habere ingreſſum.

VI. In furno vero toſtorio (*Roſt-olfen*) ubi flammæ igneæ mineram contingunt, adhæreſcit camino vel ductibus adſtructis, ſicuti pulvis (*Mehl*) cinereo-albicantis coloris, qui colligitur pro conficiendo illo arſenico albo cryſtallino.

VII. Re-

VII. Remanet terra fixa, cinerea, vitreſcibilis.

VIII. Minera Biſmuthi (de qua quidem hoc loco ſpecialiſſimus ſermo non eſt, tamen cœruleo maximè inſerviens, non prætereunda) igne aperto facilè effluere ſinit ſubſtantiam ſemimetallicam, quæ Biſmuthum appellatur, & ad alios uſus venditur; & relinquit lapidem ſeu terram itidem griſeam, fixam, dictam *Biſmuth-graupen.*

IX. Minera illa quantum poſſibile, ſi pura, ſegregatur ex Cobalto ſtrictè ſic dicto, ut Biſmuthum colligatur. Sed interdum, imo non raro illud ita inſperſum & intertextum eſt, ut ſeparari ab hac minus planè queat; hinc in ollis vitrificatoriis ſubſidet ſubſtantia regulina, dicta *Speiſſe*, coloris communiter albo-ſubrubicundi; quæ tamen rarò vel nunquam Biſmuthum ita purum eſt, ſicuti hoc ex ſua minera per ſe emanat, ſed commixtam ſibi habet peregrinam inter alia terram fixam cobalticam. Atque ita novis compoſitionibus vitrificatoriis iterum commiſcetur. Subdividunt aliqui regulum hunc in Marcaſitam, *Glokenſpeiſſe*, & æs caldarium, quorum illa inferius, hoc ſuperius hæret.

X. Terra utrinque remanens fixa, per ſe difficillimè vel planè non in vitrum abit, quamvis in furno vere vitrificatorio per 8 horas illam detinuerim, vix quod unam vel alteram maculam ſubcœruleam crucibulo Haſſiaco adnotaverit. Et quoniam ſabuli granula argillæ vaſorum iſtorum inhærentia concurrunt, dubium adhuc manet, utrum per ſe talis ſit, quæ ſine addito cœruleum poſſit conſtituere vitrum; quin hoc negandum mihi inde videtur, quia maſſa, ubi vas non tangit, non niſi griſea eſt & manet.

XI. Terra

XI. Terra iſta non planè ſterilis, ſed metalli particeps eſt. Quod cuprum hoc ſit, facilè præſumitur, ſi non è colore ſolutionum, tamen ex vitro cœruleo planè inde confecto, & ex agnata Cobalti minera, *Kupfernikel*. Quod verò pauciſſima metalli qualitas hic ſit, non ſolum ex levitate terræ, ſed etiam exinde apparet; quia neque ex Cadmia optima, neque ex agnata, utut à Venere denominata, ſubſtantia metallica cuprea ullatenus elici & colligi poteſt. Quicquid autem de cupri portiuncula prætendi queat, illa tamen per ſe, quæ ſit, definienda non eſt, niſi quod dicamus, eam Cadmiæ peculiarem eſſe atque ſpecificam.

XII. Datur Cobaltum, quod etiam intoſtum, vitrum cœruleum porrigit, imo quandoque elegantius, quam ubi toſtum fuit; quod non ex aſpectu mineræ, ſed per experimentum diſcendum eſt.

XIII. Itidemque per experientiam eluceſcit cognitio circa ignis gradus & continuationem, ſiquidem alia minera longiore & breviore, fortiore & leviore opus habet toſtione.

XIV. Adjuvatur & vitrificatio & coloris elegantia per additum pulverem arſenicalem, imo arſenicum cryſtallinum ipſum.

XV. Regulæ quidem non planè non univerſales proſtant, ad quas Cobalti tractatio pro cœruleo vitro inſtituenda eſt; ſed non conſtantes, quod jam ſignificavi. Opus igitur eſt non ſolum in privato laboratorio variis, iiſque tam ſecundum proportiones, quam ignis modos & gradus, & reliqua, experimentis; ſed & in officinis Cobalti ipſis, ut docimaſta indefeſſe experiendo invigilet naturæ mineræ & affixarum, atque

ita

ita compoſitionibus & laboribus, utpote in re colorum quaſi delicatiſſimis, rectè proſpiciat, iiſque ad votum minus ſuccedentibus vel addere, vel abſumere, vel corrigere aliter ſciat.

XVI. Cobaltum igitur in hunc finem experturus, probe oculis conſideret illud, utrum & quam purum à lapide & adhærentibus, vel hoc minus aut quam minus ſit: torre vel calcina, donec fumi ceſſent; commiſce pulveri remanenti ſilicis vel ſabuli ſilicei puriſſimi, albiſſimi, 1, 2, vel 3 partes, cinerum clavellatorum vel partem, vel pro fluxilitatis mineræ gradu plures, miſce probe, ingere in crucibulum, ſi datur, ſubtus conicum, quali utuntur cuprum experientes, *Kupfer-Tiegel.* Si bene fluxerit, quod baculo ferreo experieris, quodque ocius ſeriuſque fit, quatenus furnus & ignis ſunt, exime crucibulum, & frigefactum vitrum ſcoriis ſepara; ſeparatum pulveriſa, non in vaſe ferreo, utpote colorem obſcurante, ſed, ſi proſtat, in porphyrio, vel alio duriſſimo lapide; pulverem lava ab eo, quod albicantis ſive griſei coloris eſt, *Eſchel* ſeu *Schlamm* vocatum, atque tum hoc, tum illud deſicca; deſiccatum utrumque trajice per cribrum anguſtiſſimum; quod craſſum, iterum tere cum aqua, deſicca, donec omne comminutum ſit. Tandem confer cœruleum obtentum tuum cum exemplaribus cololorum, (*Muſter,*) quæ gradus, ordinem, titulos atque pretium ſuum publica lege jam conſtituta habent, & videbis, quid Cobaltum ſumptum importet, & ubi error aliquis factus ſit.

XVII. In groſſo, ut aiunt, procedendi hic modus eſt. Cobalti minera è puteo tracta, ab heterogeneis omnibus malleo, quantum poteſt, ſeparata, calcinatur in furno, qui fornicatus, latus, plani ferè fundi eſt, atque ignem flammeum ab alio prope adſtructo furno anemio ſuper mineram recipit. Huic ex oppoſito furni

anemii introitus apertus eſt, ubi quidam rutro Cobalti terram circumvolvit, quo ignis undiquaque in eam agat, atque arſenicum eò melius disjiciat, donec non amplius fumet. Adhæc calcinantur ſilices electi puriſſimi, & jam candentes projiciuntur in aquam frigidam, ut magis tractabiles fiant; ita præparati tunduntur in pulverem ſeu ſabulum. Tum Cobalti toſti pars una cum ſilicum partibus ut plurimum tribus, & ut eo facilius fluat, cinerum clavellatorum parte una, in ciſta quadam commixta funditur in furno vitrificatorio, in magnis ollis, igne per 8, 10, imo 12 horas intenſiſſimo; atque operarius (*der Schurknecht*) unco ferreo magma jam fluens ſtrenuè circumagitet, ut omne in æqualem fluxionem abeat. Ubi tandem, quam poteſt limpidiſſimè fluit, cochleari magno ferreo vitrum exhauritur, & in alvearium, aquâ repletum, projicitur. Vitrum ita magis friabile redditum tunditur malleo, quem aqua agit (*gepucht ;*) tuſum trajicitur per cribrum orichalceum. Remanens ulterius tunditur, & trajectum in mola cum aqua ſubtiliſſimè pulveriſatur. Hoc lavatur tum ad abſterſionem particularum ſalinarum, aliarumque ſordium, tum ad ſeparationem pulveris illius cinerei albicantis levioris, quem *Eſchel* appellant, à cœruleo, quod *Blaue Farbe* dicitur, ſecundum rationem, quod aliàs *Schlemmen* dicunt. Tandem in vaſa per centenaria conditur, & per totum terrarnm orbem divenditur. Sicut verò hujus rei, atque hinc pretii maxima differentia eſt, ita vaſa certis litteris notantur, ita ut O.C. ſignificet *Ordinair Cobolt.* M. C. *Mittel Cobolt.* F. C. *Fein Cobolt.* F.F.C. *Fein, Fein Cobolt.* F.F.F.C. *Fein, Fein, Fein Cobolt;* id quod vero ut pretioſiſſimum, ita & rariſſimum eſt. Minera Cobalti ita præparata, aliàs Schmaltum, *Smalte*, & mulieribus, *blaue Stärcke*, quo utuntur pro linteis dealbandis, communiter appellatur.

XVIII. Ven-

XVIII. Venditur & Cobaltum tantum toſtum & cum duabus vel tribus partibus ſilicum vel quarzi commixtum, ſub titulo *Zaflor*, item *Zaffera*, pro figulis. Ubi hoc meretur commemorari, quod pulvis hicce in vaſis, quibus devehitur, tam compactum fiat, & quaſi concreſcat, ut duri lapidis inſtar, malleo opus habeat ad comminuendum.

XIX. Cæterùm Cobaltum per ſe argentum non continet. Quamvis enim detur ejuſmodi vena, ex qua nobile hoc metallum excoquatur, tamen non niſi per accidens fieri exinde liquet, quia eadem vena illic plus, hic minus, & ut plurimum planè non argentifera eſt.

XX. Hoc non obſtante, argentum nativum ſuper Cobaltum non rarò reperitur, quod verò non aliud, quam hoc arguit, mineram illam argenti non incongruam eſſe matricem.

Tantùm ferè eſt, quod, propriâ experientiâ de Cobalto cognitum, recenſione dignum duxi. Quod ſupereſt, L. B. rogo, hanc rudi, quod dicunt, Minervâ conſcriptam commentationem, ſereno vultu velis ſuſcipere, & cogitare, quod nec ego iſtud abs me alienum arbitrer, quicquid iis ſolet accidere, qui, nullo duce prævio, fragoſas & inacceſſas vias, ad Naturæ arcem tendentes, primi invadunt. Vale. Perſcripſi *Lipſiæ*, Menſe *Quintil.* A. R. S. MDCCXXVI.

F I N I S.

ERRAT. Pag. 197. Lin. 24. lege *laudatus*.

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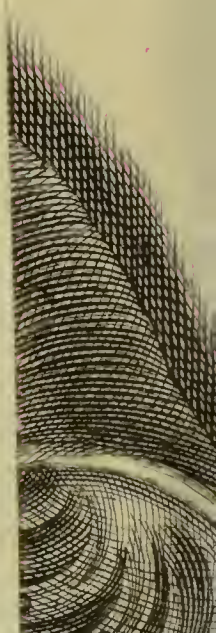

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Fig. 3.

Fig. 1.

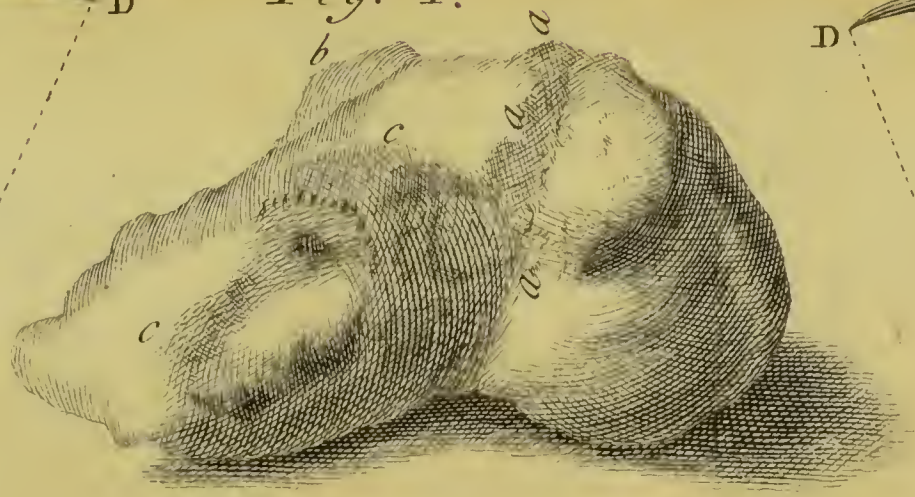


Fig. 4.

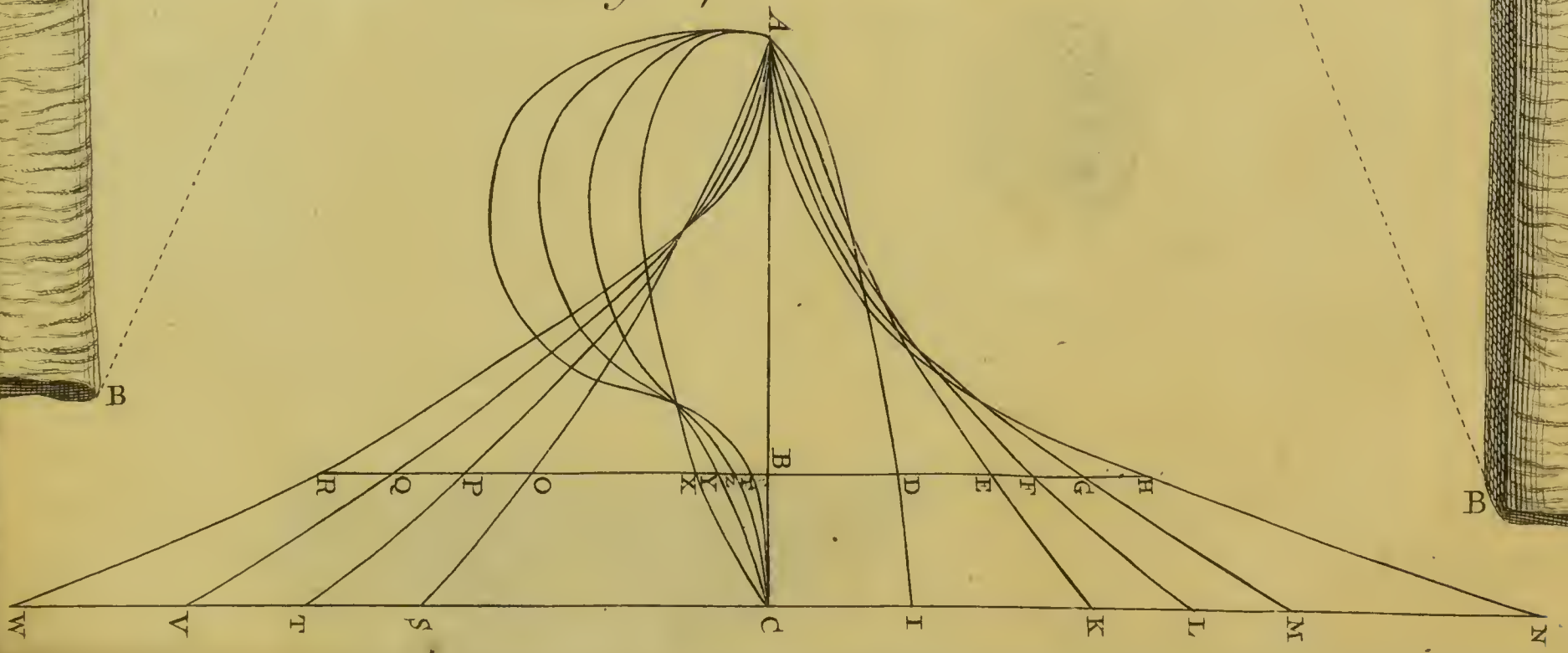
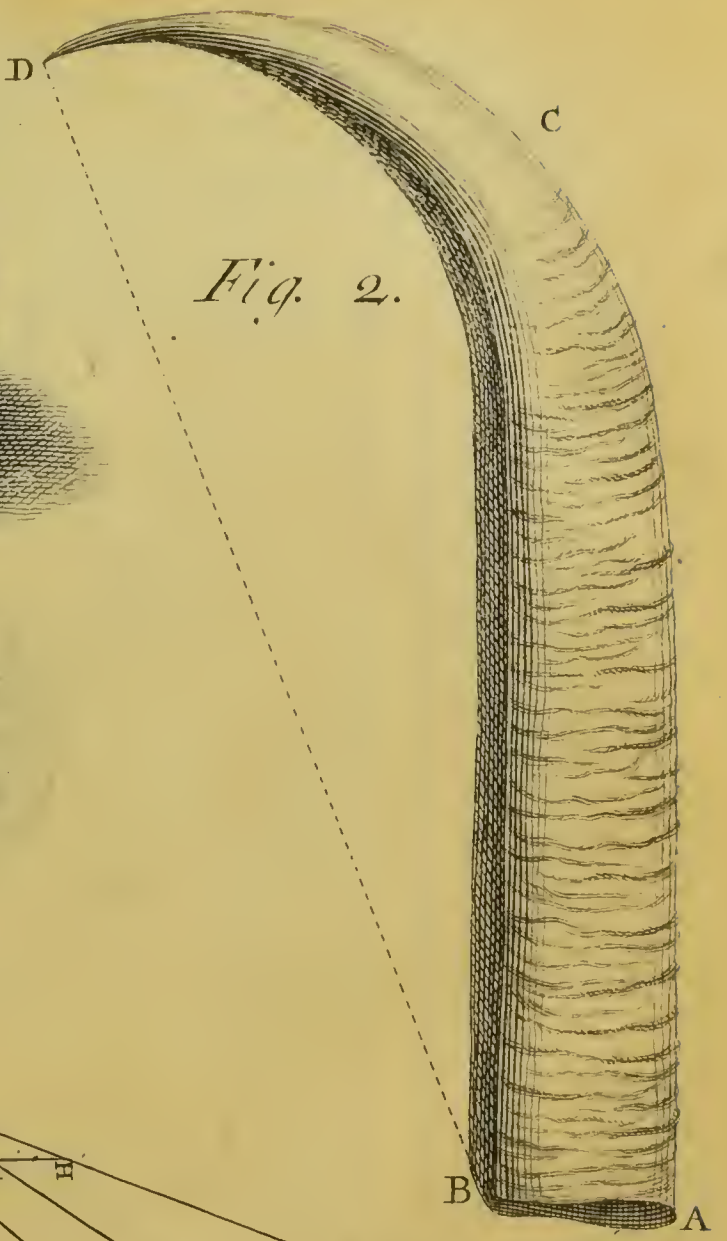


Fig. 2.



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PHILOSOPHICAL TRANSACTIONS.

For the Months of *January*, *February*, and *March*. 1727.

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I. *Re-*

I. *Remarks upon ſome Diſſertations lately publiſh'd at* Paris, *by the Rev.* P. Souciet, *againſt Sir* Iſaac Newton's *Chronology. By Dr.* Edmund Halley, *Aſtronomer-Royal, F. R. S.*

THere has been lately put into my hands a Book publiſhed laſt Year at *Paris* by Father *Souciet*, Jeſuit, againſt our late Preſident Sir *Iſaac Newton* his *Chronology*, without waiting till the Book be publiſhed, and without knowing the Contents thereof, otherwiſe than by a ſhort Extract, made at the deſire of a very great Perſon, and without intention that it ſhould be publickly ſeen. However, a Copy thereof having been (as I ſuppoſe) ſurreptitiouſly obtained and carried over into *France*, the ſame was firſt tranſlated into *French*, and then printed at *Paris* with a pretended Refutation thereof by the ſame *P. Souciet.* Since then, Sir *Iſaac* having anſwered, as he thought, his Objections, has thereby given him a handle to publiſh five other Diſſertations againſt the new Syſtem of Chronology, as he calls it; the firſt and laſt of which, being chiefly Aſtronomical (ſince the great Author is no more) ſeem properly to fall under my examination, both on account of the Poſt in which I have the honour to ſerve his Majeſty in quality of his Aſtronomer, as alſo from the long Acquaintance and Friendſhip that has ſubſiſted between the Deceaſed and my ſelf.

And firſt, I obſerve, that *P. Souciet* readily allows what ſeems to be the moſt exceptionable part of the whole Syſtem, *viz.* that *Chiron* the Centaur fixt the

Colures, in the ancient Sphere of fixt Stars, in the ſame places as *Hipparchus* tells us they had been ſuppoſed by *Eudoxus* many Centuries of Years after *Chiron*. His words are theſe, ἐν δὲ τῷ ἑξῆς κολέῳ φησὶ κεῖσθαι τὸν κήτους τὴν κεφαλὴν, καὶ τὸ κεῖσθαι τὰ νῶτα κατὰ πλατύ. This, undoubtedly, was the Poſition of the Colure of the Vernal Equinox many Ages before *Eudoxus*; but whether ſo old as *Chiron*, and the *Argonautick* Expedition, I ſhall not undertake at this time to enquire; but only obſerve, that *P. Souciet* in his *Faſtes du Monde*, or Abridgment of his Chronology, prefixt to theſe Diſſertations, makes the *Argonautick* Expedition 1467 Years before our *Æra* of the Birth of Jeſus Chriſt; and the taking of *Troy* 1388 Years before it, which Date is 120 Years ſooner than the *Parian* Chronicle, read and publiſht by our Learned *Selden* in his *Marmora Arundeliana*, makes it; and above 500 Years earlier than the time aſſigned by Sir *Iſaac Newton*.

Now both of them making uſe of the ſame Premiſſes, it may ſeem ſtrange that their Concluſions ſhould be ſo widely diſtant: And indeed upon a Præpoſſeſſion that the *Argonautick* Expedition and the Siege of *Troy* could not have been leſs than 1000 Years before Chriſt, I muſt own, I was at firſt ſomewhat prejudiced in favour of *P. Souciet*, taking his Calculations for granted; and not having ſeen Sir *Iſaac*'s Work. But obſerving that he quotes Sir *Iſaac*, as ſaying, that in conſequence of what *Hipparchus* has recorded from *Eudoxus*, the Equinoctial Colure in the old Sphere was about 7° $36'$ from the firſt Star of *Aries*, I was reſolved to examine the matter with due Attention, eſpecially ſince the Good Father ſeems to triumph over his Adverſary, and to treat a Man of his Figure in the Common-wealth of Learning in a very ludicrous manner, notwithſtanding the ſeveral fine things he ſays of him to palliate it.

I find

I find the Diſpute to be chiefly over what part of the Back of *Aries* the Colure paſt: The Words of *Hipparchus*, as from *Eudoxus*, are ſimply, that it paſt over the Back, without ſaying over what Star, or over what part of the Back it paſt. And the ſame *Hipparchus* ſhews, that if it paſt over the Star in the middle of the Back, it greatly differed from the Situation thereof in his time; and conceiving thence that the Æquinoctial Points might have a regreſſive motion, he was the firſt that attempted to define their motion; but having no Obſervations older than thoſe of *Timocharis*, made within leſs than 200 Years of his own time, and very courſe withal, he was not able to determine the quantity thereof, but gueſt it to be about a Degree in 100 Years; which, length of time, and the more curious Obſervation of the Moderns, has now proved to be 1° 24′. or rather 50″ *per Annum*.

In a word, Sir *Iſaac* takes the Colure to have paſt over the middle of the Conſtellation of *Aries*, and very near the Star in the middle of the Back (*ν Bayero*). And *P. Souciet* will have it, that it paſt over the middle of the Sign or *Dodecatemorion* of *Aries*, reckoning the Sign to begin with the firſt Star of the Conſtellation; and by conſequence his Colure muſt paſs about midway between the Rump and firſt of the Tayl of *Aries* (ε and ζ *Bayero*;) which Situation could never be ſaid to be over the Back: But whilſt Sir *Iſaac* makes the Colure but 7° 36′ from the firſt Star of *Aries*, which *P. Souciet* makes 15 Degrees from it, the difference 7° 24′ at 50″ *per Annum*, makes 533 Years difference in the reſult.

Let us now examine when the Stars in queſtion did actually paſs under the Colure of the Vernal Æquinox, aſſuming their places as they are in Mr. *Flamſteed*'s *Britiſh* Catalogue, fitted to the beginning of the Year 1690.

He places the first Star of *Aries* in 28° 51′ of *Aries* with 7° 9′. North Latitude. And supposing the Obliquity of the Ecliptick 23° 29′, it will be as Radius to the Tangent of 23° 29′ : : so the Tangent of 7° 9′ to the Sine of 3° 7′ ½, the difference of Longitude between the Star and the Point in the Ecliptick which past under the Colure, at the same time with the Star; so that this Point was, *Anno* 1690 *ineunte*, in ♈ 25° 43′ 30″, and therefore allowing 50″ *per Annum*, the Star was under the Colure 1852 Years before the *Epocha* of the *British* Catalogue, that is, 162 Years before our *Æra* of the Nativity of Jesus Christ; in which very Year *Hipparchus* began to observe the Æquinoxes recorded by *Ptolemy*, *Lib.* III. *Cap.* 2.

If therefore with Sir *Isaac* we add 7° 36′ to the Long. of the first Star of *Aries*, as it was in 1690, we shall have 36° 27′, which the Colure moves in 2624 Years: And deducting 1690 therefrom, we shall have 934 Years before Christ for the *Argonautick* Expedition. And if to 7° 36′ we add 3° 7′ ½ we shall have 10° 43′ ½, that is, 772 Years before the first Star of *Aries* past the Colure.

Next let us inquire when the Star in the middle of the Back of *Aries* (*ρ Bayero*) past the Colure. Its Longitude *Anno* 1690 *ineunte*, was 9° 48′ 35″ of *Taurus*, with North Lat. 6° 8′; but by the foregoing Analogy, the Point in the Ecliptick, over which the Colure past at the same time with it, was 2° 40′ ½ before it, that is, in ♉ 7° 8′. Now 37° 8′ give 2674 Years nearly, or 984 Years before Christ, when that Star was under the Æquinoctial Colure, being but half a Century earlier than Sir *Isaac* places the *Argonautick* Expedition; and shews that he took the middle of *Aries* over which the Colure is supposed to have past, to be the middle of the Constellation, and not of the *Dodecatemorion*, and in so doing,

doing, no doubt, had reaſon to place this Colure 7° 36′′ in conſequence of the firſt Star of *Aries*, inſtead of 8° 17′, as it was when the Star in the middle of the Back of *Aries* was under the Colure.

But if with *P. Souciet*, you make the Colure to interſect the Ecliptick 15 Degrees from the firſt Star of *Aries*, or 43° 51′ from the Æquinoctial Point, as it was *Anno* 1690, we ſhall have the time nearly 1470 Years before Chriſt; but then the Colure will be very far from the middle of the Back of *Aries*, and leave only his Tayl to the Eaſtward, as it leaves the Head of the Whale to the Weſtward, ſo as by no means to agree with the Deſcription we have of it from *Hipparchus*; which it were to be wiſht had been more definitive, and as well circumſtanced as what *Hipparchus* has left us of the Poſition of the Colures in his own time, which upon examination I find to be very conſiſtent, and the Obſervations made with ſufficient care.

Thus I hope, I have ſhewn *P. Souciet*, that there was no Affectation of Myſtery in Sir *Iſaac*'s placing the Colure 7° 36′ from the firſt Star of *Aries*, nor any occaſion to drole as he does Pag. 131, 132. on that account; as alſo that he ought to have deducted 3° 7′½ out of the 15 Degrees he aſſumes for the diſtance of his Colure from the firſt Star of *Aries*, which will bring him 225 Years nearer to Sir *Iſaac Newton*'s time. He is likewiſe entreated, in the next Edition of his Diſſertations to be a little more careful of his Numbers than he has been Pag. 134, 135, and to inform himſelf in the Sphericks, ſo as to give us the Right Aſcenſions of the Stars truly, from their given Longitudes and Latitudes.

Laſtly,

Laſtly, I would inform him, that the Star in the Centaur which *Hipparchus* diſcribes, as being in his time very near the Autumnal Colure, was not ♆ of *Bayer*, but certainly Φ, and that, *anno ineunte* 1690, its Longitude was *Scorpio* 8° 43′ 40″, with South Latitude 27° 59′. But the Colure paſſing through that Star, by the Proportion given above, cuts the Ecliptick 13° 20′ 50″ in Antecedence of the Star, that is in *Libra* 25° 22′ 50″. But 25° 22′ 50″ give 1827 Years: Wherefore the Time this Star was in the Colure was 137 Years before Chriſt, when *Hipparchus* flouriſhed, and might very well obſerve it.

II. *An Account of a large Stone voided through the Urinary Paſſage, by a Woman. Communicated by Dr.* Richard Beard, *F. R. S. Phyſician at* Worceſter.

Worceſter, Jan. 29, $172\frac{6}{7}$

SIR,

AMidſt the variety of Obſervations, that have been made on the extraordinary Powers of Nature, that which follows may deſerve a place. A poor Woman in the Pariſh of *Fladbury* in this County, aged 63, about 3 Years ago, was afflicted with the uſual Symptoms of a Stone in the Kidneys, and afterwards in the Bladder. The Fits of Pain occaſioned by it increas'd as its Bulk did; till ſhe was ſo emaciated by 'em, that her Caſe was judg'd deſperate. Finding relief (towards the end of laſt Summer) by a plentiful uſe of Mallow-Tea, ſhe perſiſted in it for a while; when on a ſudden, in the preſence of ſome Women, ſhe perceived an uncommon weight and force within, which aſſiſting with all the Strength and Breath ſhe had left, a Stone came away with a Noiſe that very much ſurpriz'd the whole Company, and with leſs Pain and Effuſion of Blood then, or Soreneſs afterwards, than might have been expected. She is ſince eaſy and in health, and feels no other Inconvenience now, but that unavoidable one, an *Incontinentia Urinæ.*

The

The Stone (of which I ſend you the ſide-View *Fig.* 1. drawn as near to the Life as we could) is of the ſame Colour and Texture with others of this kind that I have ſeen, formed in humane Bodies. Its weight, as I at preſent find it, is, ℥ ij. ℥ j 55 *gr. Avoird.* When firſt voided, 'twas conſiderably more, ſeveral Pieces having been rubb'd off at *c c*, and likewiſe on the other ſide: The greateſt Circumference is 7 Inches and $\frac{1}{2}$; 'tis 4 Inches $\frac{3}{4}$ round at the thickeſt place, and the length on the Convexity is 4 Inches $\frac{7}{8}$; the parts of the Stone at *a a a* are ſomewhat jagged and ſtain'd with Blood, as is the little Protuberance on the oppoſite ſide *b* Here I ſuppoſe, it met with the moſt reſiſtance, at the time of its Expulſion thro' the Urinary Paſſage.

III. *An*

III. *Observations upon the Comet, that appear'd in* October 1723, *made at* Bombay; *and upon an Eclipse of the Moon,* Oct. 21, 1724, *at* Gomroon *in* Persia. *By Mr.* William Saunderson. *Communicated by Dr.* Halley, Astron. Reg. R. S. S.

Bombay, Sept. 12, 1725.

IN the Month of *October* 1723, being riding at *Bombay*, a Brightness in the Heavens appear'd in a Right Line, (or but very little to the Eastward of one) with *Lyra* and the Bright Star in the *Eagle*, being about 50° distant from the last; and on *Monday* the *7th* following it had advanced 10° toward the *Eagle*, moving towards it in the forementioned direction, from the S. E. Quarter. I took the following Distances between 9 and 10 at Night, as in this Table.

October. Days.		Dist. from the *Eagle's* Heart. °	′	
1	7	40	00	South
2	10	23	50	
3	11	20	30	
4	13	17	40	
5	15	14	40	
6	19	11	40	

At first it looked only like one of the White Spots called the *Magellanic Clouds*, the Space filling the Field

of a Six-foot Glaſs. Afterwards I ſaw the Head in the Center of the illuminated Space, which did not look with much Brightneſs; but appeared largeſt on the 10*th* of *October*, decreaſing gradually both in its Bulk and Motion from that time until the 25*th*, at which time I could find no Appearance of it with the fore-mentioned Glaſs. *N. B.* From the 20*th* to the 25*th* it had nearly the ſame Place in the Heavens, ſeeming to move directly from the Earth. *October* the 21*ſt*, 1724, being at *Gomroon* in *Perſia*, the Moon entered into the dark Shadow or *Umbra*, of the Earth at 11^{h} 33$^{\prime\prime}$ paſt 5 A. M.

IV. *A Letter from the Reverend Mr.* Edmond Barrel, *Rector of* Sutton *in* Kent, *to Sir* Hans Sloane, *Baronet, Preſident of the* Royal Society *and the College of* Phyſicians, *concerning the Propagation of* Miſſelto.

SIR,

IT hath been my Purpoſe, ever ſince the Death of our late worthy Friend Mr. *Hill*, to communicate to you, (if you would pleaſe to accept of it) an Account of the Growth of *Miſſelto* from the Seed: and I have delayed it from Year to Year, not only to be better aſſured in my Experiments, and to find whether the World had not already, or would not be in the mean Time, better informed of this, by ſome other Hand: But I was alſo in hopes to have been ſo ſucceſsful ſome Year or other, as to have been able, to ſend you and the *Royal Society*, ſome Specimens of the ſeedling Plants, both of the firſt and ſecond Years growth together. I am ſorry that I cannot do this now, and for that reaſon ſhould have delayed this Account, till another Year. But your kind Acceptance of ſo ſmall a Curioſity as I ſent lately, obligeth me to a preſent Compliance with your Requeſt.

The Berries of *Miſſelto* have within their viſcid Pulp a Kernel covered with a thin whitiſh Skin; the inward Subſtance whereof is deeply green, and harder than the Subſtance of a *Piſtachio*-Nut's Kernel. It is flattiſh, and ſhaped ſometimes like a Heart thus ♡; ſometimes oblong thus, *O*; both are as truly

Seed, as any Plant can have. Thoſe of the oblong Shape put out but one *Germen*; thoſe like an Heart, have two, which prove two diſtinct Plants.

Sir *John Colebatch* recommends the ſowing this Seed by way of Inoculation: Accordingly in *Feb.* 17$\frac{1}{2}$, I endeavoured to place the Berries, within the Bark of *Oak*, *Aſh*, *Beech*, *Pear*, and *Apple*-trees, by making ſeveral Cuts and Gaſhes in the upright Sides of the Trees. The whole Berries would not ſtay in any of them; and when I broke them, the Seed always ſlipped out to the Edge of the Cut, and then it ſtuck to the Bark, by virtue of the ſlimy ſubſtance wherewith it is encompaſſed. I alſo ſtuck one Seed on the bare Bark, without any cutting at all: This ſucceeded beſt, and being the Heart-like ſhape, gave me two Plants. For about the 28*th* of *March* 1719, this, with two more on the *Apple*-tree, and one on the *Pear*-tree, began to ſhoot; and the Growth was in this manner:

The Viſcous Matter having ſtuck the Seed on, and (as it dried) drawn the Seed cloſe and flat down to the Bark of the Tree, there began, in *March* and *April*, to ſpring out of that end of the Seed, which had been toward the Eye of the Berry, a ſmall deep green Shoot or Twigg, very like a ſhort Piece of a little Claſper of the Vine. At firſt, it aroſe upward from the Bark, and then turning again, as it approached the Tree, it ſwelled out ſomewhat bigger round about the End; yet leaving the very Tip or Bottom, quite flat, forming (as it were) a Foot to ſtand upon; not unlike the bottom of ſome Braſs Peſtles. This Foot, when it came to the Bark, which was about *May* or *June* 1719, fixed it ſelf thereon. Being thus faſtned at both Ends, it made a little Arch, whoſe Diameter was as long as the Seed, or about $\frac{1}{10}$ of an Inch.

In

In this Condition, it remained all that Year, till about *March* or *April* 1720, and then that part or end of our little Seedling, which was joyned to the Bark, at the place where the Seed firſt ſhot forth, let go its hold, and raiſing it ſelf upward, put forth Leaves, and became the Head of the Plant: and the other end, which ſprung out firſt, and had taken footing in another Place, became the Root of the Plant.

'Tis no uncommon thing, for Seeds of *Ever-greens* to be two Years before they ſpring out of the Ground. And the change of the Ends, firſt one of them ſhooting out, and then the other, was what ſurprized me moſt at firſt; but on further reflexion I found, that Nature, even in this ſtrange Plant, is uniform to her other Productions; in carrying the Sap firſt one way to form the Root, and then turning the Courſe of it back again to ſend out the upper parts of the Plant. The ſtrangeſt and moſt wonderful part is, that the rooting End ſhould make its firſt ſhoot into the open Air, and then turn it ſelf down, to find a proper Place to fix upon. Who could have ſuppoſed, that a Plant, whoſe Berry is the moſt orbicular of any, and therefore the leaſt likely to lie quiet in any Situation, and whoſe proper place of growth is a round and wavering Bough, or upright ſide of a Tree, ſhould after it is once fixed, leave its firſt footing, and ſeek out a new point in the Bark to grow upon.

This is indeed the great Secret of the matter, and ſeems to be the very thing that hath kept the World in Ignorance, about the growing of this Seed. For by requiring a new ſmooth Place of the Bark, whereon to fix the rooting Part, it hath fruſtrated all attempts of ſowing it in the uſual way of other Seeds.

Theophraſtus, (about two Thouſand Years ago) ſeems to endeavour at a Reaſon, why this Seed could not grow in the Earth: But all that he, or any one ſince, hath ſaid upon it, is only to agree, that in Fact it doth not, and to wonder why ſo perfect a Seed ſhould not grow in the Earth. That Antient Author rationally concluded, from its having a Seed, that the Plant muſt come from that Seed: Whereas latter Times have been ſo fond of allowing Chance a ſhare in the Productions of Nature, that *Scaliger* hath not only experimentally confuted the common Notion of *Miſſelto*'s being ſown in the Dung of the *Thruſh*; but argueth alſo, very ſtenuouſly againſt the Poſſibility of this Plant's growing from its Seed. Even the great Lord *Bacon*, Sir *Thomas Brown*, *Lobel*, and the inquiſitive Mr. *Ray* (ſo late as 1673,) do all give into it, that this Plant, hath a ſpontaneous and æquivocal, rather than a ſeminal and univocal Generation.

Scaliger's ſtrongeſt Objection is, *Quod è Ramis quibuſdam exit Viſcus, quo in loco nullis modis vel ſtercus conſiſtere, vel ſemen unquam potuerit hærere — Nihilo enim commodius conſiſtere quam in re proclivi Globum.* *Lobel* objects againſt it, becauſe of the Imperfection of the Berry *Acinulo illo pallido pellucido.* Mr. *Ray*'s Argument is, *Viſcus innatus etiam in pronâ Ramorum parte.*

'Tis the property of true Experience to clear up Doubts, and anſwer Objections: And if Nature had been well examined, it would have appeared, that this Seed is of a ſubſtance equal to other Kernels; and that the Pulp of the Berry, wherewith the Seed is ſurrounded, is of a more clammy ſticking nature than the Pulp of other Berries, for this very Purpoſe, that it might be of ſtrength ſufficient to fix the Seed on any Tree, how moveable or upright ſoever the Bough or Twig ſhould be whereon it chanced to light. And

And doubtleſs the Birds are (tho' not by their Dung) Sowers of this, as they are of many other Seeds, which they carry away for Food; but often drop in Places where they could otherwiſe never have come.

While I was writing this out for your Peruſal; I went to gather ſome *Miſſelto*-Berries (this being the Seaſon that they are ripe, and fitteſt to be ſown) and found a Leaf (which I ſend you) which hath a Seed ſticking thereon; doubtleſs by a caſual Fall out of the Bill of ſome Bird, that has broken the Berry as ſhe was eating it. There is both a dry ſtring of the Slime, and a dry ſpot of the ſame, upon the Leaf, that ſhow how the Seed was detained there, in this Caſe; and how it muſt be done in like manner any where elſe.

When I acquaint you, Sir, that I have ſown theſe Seeds, on near thirty ſorts of Trees and Shrubs, and yet never had above ten Plants, that held out the ſecond Year; you will not wonder, at the little ſucceſs, that others have had, in their trials of this Seed; and will alſo ſee the Reaſon, why I have not been able to make many other Experiments about the growth of this Plant. However, ſome Caſualties have furniſhed me with two or three; which I beg leave to relate; becauſe they do ſomewhat further explain the Nature of this Plant's growing.

One of my little Plants ſown in *Apr.* 1724. which was fixed at both Ends in its Arch-like Form, had in *Sept.* 1724, the middle part broken off; the two Ends keeping ſtill faſt to the Tree. Which ſhews, how firmly the two Ends adhere, while it is in that ſtate; and they both continued green ſome time, and then withered away.

2. That

2. That one Seed, which grew on a *Pear*-tree, in 171$\frac{8}{9}$, was the next Spring 17$\frac{19}{20}$, looſened from the Tree at one End, as the others were: Yet this ſeedling Sprout, never put out any Leaves at all; but continued in the ſame ſtate, neither bigger nor leſs, near ſix Years; that is, till it was broken off by chance in *July* 1725. This ſeems to me a very ſtrange thing: For, a ſeedling Plant (of any kind) is, but as it were, an *Embryo*, till it have put forth Leaves.

3. My moſt thriving pair of Plants, of the Year 171$\frac{8}{9}$, being about three Inches in length, were on the 21*ſt* of *May* 1722, ſtruck off, by the falling of a Rake-handle againſt them. They took away with them, only the outmoſt thin skin of the Tree; and I could not ſee any ſigns, of deeper Rooting. But as I looked, now and then, on the Place, where the *Miſſelto* had grown, I thought, I obſerved the Bark to ſwell up a little; and on the 12*th* of *March* 172$\frac{3}{4}$, I perceived 3 or 4 little Budds, putting forth, and another Budd was put out by the 18*th* of *March*. They all grew on, to have Leaves that Summer; and now *Febr.* 172$\frac{6}{7}$, they are a Cluſter of Boughs, of 4 or 5 Joints in heighth, and bore Berries this Winter; whereas two others, on the ſame Tree, and which were alſo ſown at the ſame time, in 171$\frac{8}{9}$, and are 6 or 7 joynts in heighth, have not yet born any Berries.

The thriving of theſe Plants, ſo well again, after they were broken off; made me reflect, on the *Druids* way, of cutting *Miſſelto* from the *Oak*, with a Golden Inſtrument; a Metal not apt to take a good Edge; and poſſibly, the bluntneſs of the Inſtrument, might be a means, to preſerve, a future growth, of the ſame Plant; which, doubtleſs, they as well as we, find to be very rarely upon the *Oak*. I might ſuggeſt ſome Rea-

Reaſons for this Scarcity, from the Nature of that Bark; and I might obſerve many miſtakes, into which both Modern and Ancient Writers run, when they mention this Plant. But I have been ſo tedious already, that I will not trouble you, Good Sir, with any more, than this one Obſervation; which is, that there is almoſt every Year, on moſt *Miſſelto*-Buſhes, a viſible Proof, that the Kernel hath a vegetative Life in it: For when the Berries hang on till *May* or *June*, the Seed will make its little Shoot in the Berry, as the Kernels of Lemons, and you may ſee it coming out at the Eye of the Berry.

V. *An Account of a Pair of very extraordinary large Horns found in* Wapping *ſome Years ſince, with a probable Account, whence they came, and to what Animal they belonged. By Sir* Hans Sloane, *Baronet, Preſident of the Royal Society, and of the College of Phyſicians.*

MAny Years ſince, Mr. *Doyly*, (who was a great ſearcher after Curioſities, and gave Name to a ſort of Stuffs worn in Summer,) found a Pair of extraordinary large and ſtrangely ſhaped Horns in a Cellar, or Warehouſe, at *Wapping*, where they had ſuffered much by Worms and otherwiſe, being eaten pretty deep on their Surfaces, in many Places. They had lain there ſo long, that when he bought them, no body could inform him, either of the Country whence they came, or when, or how they had been lodged there. They reſembled in ſeveral things the Horns of Goats, which made many People think, that they had belonged to an Animal of that kind, in all likelihood as large as the *Mouſe-Dear* in *America* is of its kind. The Royal Society being informed of this matter, Mr. *Hunt*, their Operator at that time, made a deſign of them, on which Dr. *Hook* read a Lecture at a Meeting of the Society at *Greſham-College*. This Lecture and the Deſign, are, I think, loſt; but I remember, that he ſuſpected them to be the Horns of the *Sukotyro*, as the *Chineſe* call it,

it, or *Sucotario*, a very large and odd-ſhaped Beaſt, mentioned and figured by *Nieuhoff* in his Voyages and Travels to the *Eaſt-Indies* (a), where he gives the following Deſcription of it: *It is of the Bigneſs of a large Ox, with a Snout like a Hog, two long rough Ears, and a thick buſhy Tail. The Eyes are placed upright in the Head, quite different from other Beaſts; on the ſide of the Head next to the Eyes ſtand two long Horns, or rather Teeth, not quite ſo thick, as thoſe of the Elephant. It feeds upon Herbage, and is but ſeldom taken.* Many People thereupon went to ſee them at Mr. *Doyly*'s, who was offered a conſiderable Sum of Money for them, but refuſed it, and after a very ſevere Sickneſs, wherein I attended him, very much, as he thought, to his Advantage, he made me a Preſent of them.

They are both almoſt ſtreight for a conſiderable length, and then turning crooked, they run on tapering towards a ſmall and pretty ſharp end. They are not round, but compreſſed and flattiſh, and have large tranſverſe *Sulci*, or Furrows on their Surfaces, waved or undulated on their under parts. They differ ſome ſmall matter in largeneſs. Meaſuring one [Fig. 1] from the great end, or *Baſis*, A B, where it was fixed to the Head, along the outward Circumference, I found the length ACD to be ſix Feet, ſix Inches and a half, the length by the Line B D was four Feet 5 ⅛ Inches, the Diameter of the *Baſis* A B was 6 ¼ Inches and its Circumference one Foot five Inches. This weighed 21 Pounds, 10 Ounces, and contained in the hollow part exactly five quarts of Water. In the other [Fig. 2.] the length of the outward Circumference A C D was ſix feet four inches, the Line B D four feet ſeven in-

(a) *P.* 360. *of the Engliſh Edition.*

ches, the Diameter of the *Baſis* ſeven inches, and its Circumference one foot ſix inches. This weighed 21 pound, 13 ounces and a half, and contain'd in the hollow part 4 quarts and a pint, but would have held more, if it had not been very much broke at the large end.

The Commander of an *Eaſt-India* Merchant Ship upon ſeeing them, told me, that he had ſeen ſuch in the *Indies* on a large *Bufalo*'s Head. I am inclined to think, that they muſt belong to a very large ſort of Bulls or Cows, who are Natives of *Æthiopia*, and other of the midland Parts of *Africa*, and are mentioned by many of the Ancients, perhaps not without ſome fabulous Additions, though, which is ſtrange, very few of the Modern Writers take any notice of them.

Agatharchides *, a *Cnidian* who flouriſhed about the CL. *Olympiad*, near 200 Years before Chriſt, is the firſt

* This *Agatharchides* lived in the time of *Ptolemeus Philometor*, and is mentioned by ſeveral of the Antients, as an Hiſtorian, and a Philoſopher of the Sect of the *Peripateticks*. Monſieur *le Clerc* (*Hiſtoire de la Medecine*, p. 387.) ranks him among the Phyſicians of that time, though that was not properly his Profeſſion; and the reaſon he gives for it is, becauſe he deſcribed, in one of his Books, a Diſtemper which had not been taken notice of by *Hippocrates*, nor any other Phyſician before him. We are indebted for this Particular to *Plutarch* (Sympoſiakῶn *Lib.* VIII *Quæſt.* 9) who ſays, upon the Authority of *Agatharchides*, *that the Nations about the Red Sea, amongſt many ſtrange Diſtempers, they are liable to, are troubled with a particular ſort of Serpents, (or Worms,) which breed in the Legs and Arms, where they ſometimes eat their way through, ſo as to ſhew their Head; but upon touching are apt to ſlide back, and creeping between the Interſtices of the Muſcles, occaſion intolerable Inflammations.* *Plutarch* adds, that this Diſtemper (which appears plainly to be the *Guinea-Worm*, or *Vena Medeni* of *Arabian* Writers, of which ſee my Natural Hiſtory of *Jamaica*, Vol. I. p. 126. and Vol. II. p. 190, 326. and which is a Diſtemper ſtill ſubſiſting, as well among thoſe very Nations, of which *Agatharchides* ſpeaks, as among the Negroes upon the Coaſts of *Guinea*, and the Inhabitants of ſeveral Parts of *Perſia*) had not been obſerved any where elſe, neither before, nor ſince the time of this Hiſtorian.

firſt among the Ancients, who mentions and deſcribes this large and voracious Bull; and it will appear by what follows, that moſt of the ſubſequent Writers have copied him. His Deſcription of this Animal, in ſome Remains of his Treatiſe of the Red Sea, which are extant in *Photius's Bibliotheca*, (*b*) and were from thence printed in the *Geographiæ veteris Scriptores Græci minores*, publiſhed by Dr. *Hudſon*, is, according to the Tranſlation of *Laurentius Rhodomannus*, as follows, *De Tauro Carnivoro. Omnium, quæ adhuc commemoravi, immaniſſimum & maximè indomitum eſt Taurorum genus, quod carnes vorat, magnitudine craſſius domeſticis & pernicitate antecellens, inſigniter rufum. Os ei ad aures uſque deductum. Viſus glauco colore magis rutilat quam Leoni Cornua alias non ſecus atque aures movet, ſed in pugna, ut firmo tenore conſiſtant, facit. Ordo pilorum inverſus, contra quam aliis animantibus. Beſtias etiam validiſſimas aggreditur, & cæteras omnes venatur, maximéque greges incolarum infeſtos reddit maleficio. Solum eſt lancea & arcu invulnerabile, quod in cauſa eſt, ut nemo id ſubigere (quamvis multi id tentarint,) valuerit. Idcò rectè putatur, etiam à Troglodytis, fortitudine leonis, & velocitate equi, & robore Tauri præditum, ferióque cedere neſcium.* *Diodorus Siculus* (*Biblioth. Lib* III.) hath barely, and almoſt Word for Word, tranſcribed *Agatharchides*, and hath added only the following Particulars; that the Eyes of this Animal are ſhining at Night; that after it hath killed other Beaſts, it devours them, and that, in its Attacks upon Flocks of Cattle, it is not to be terrified, either by the Strength of the Shepherds, or the great Number of Dogs. The following ſhort Paſſage

(*b*) P. 1364. Cap. XXXIX.

The

relating to this ſame Animal is taken out of *Strabo (c)*. *Sunt & ibidem* (in Arabia) *tauri feri, ac qui carnem edant, noſtros & magnitudine & celeritate longè exſuperantes, colore ruffo. Pliny, Hiſtor. Nat.* Lib. VIII. C. XXI. ſeems likewiſe to have copied *Agatharchides:* His Words are, *Sed atrociſſimos habet* (Æthiopia) *Tauros ſylveſtres, majores agreſtibus, velocitate ante omnes, colore fulvos, oculis cæruleis, pilo in contrarium verſo, rictu ad aures dehiſcente, juxta cornua mobilia, tergori duritia ſilicis, omne reſpuens vulnus. Feras omnes venantur: Ipſi non aliter, quam foveis capti, feritate ſemper intereunt.* In the XLV Chapter of the ſaid 8*th* Book of *Pliny*'s Natural Hiſtory, he mentions a ſort of *Indian* Oxen, *Boves Indici, quibus Camelorum altitudo traditur, cornua in latitudinem quaternorum pedum.* It is not unlikely, but that theſe *Indian* Oxen are the ſame with the *Æthiopian* ones above deſcribed; eſpecially if we ſuppoſe, that the Tranſcribers of *Pliny* have, by miſtake wrote *latitudinem* inſtead of *altitudinem. Solinus (d)* hath barely copied *Pliny*, with this difference only, that he calls them *Indicos Tauros*, whereas *Pliny* himſelf hath deſcribed them amongſt the *Æthiopian* Beaſts, which might very well happen, *Æthiopia* being reckoned, by ſome of the Antients, as part of *India.* The deſcription of *Ælianus (e)* agrees perfectly with that of *Agatharchides*, of whom, it ſeems, he alſo borrowed it; only he fixes the Size of theſe extraordinary Oxen to twice the Bigneſs of the common *Grecian* Ox. There is another Paſſage in *Ælianus (f)*, which ſeems to relate, both to this large

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(c) *Geogr. Lib. XVI. p.* 775. *Edit. Caſaubon.*
(d) Polyhiſtoris Cap. L. II. p. 58. Edit. Salm.
(e) Hiſt. Animal Lib. XVII. c. 45.
(f) Hiſt. Animal Lib. III. c. 34

kind

kind of *Æthiopian* Oxen, and the Horns, now in my poſſeſſion. His Words are, *Ptolomæo ſecundo ex India cornu allatum ferunt, quod tres amphoras caperet : Unde conjicere poſſumus bovem illum, à quo ejuſmodi tantum cornu extitiſſet, maximum fuiſſe.* *Ludolfus*, in his *Hiſtoria Æthiopica*, (*g*) ſpeaking of the large *Ethiopian* Oxen, conjectures, that they are the *Taurelephantes*, which *Philoſtorgius*, a *Cappadocian*, ſays, (*h*) were brought to *Conſtantinople* in his time, where he ſaw them. The Words of *Philoſtorgius*, as tranſcribed by *Ludolf* in his *Commentarius ad Hiſtoriam ſuam Æthiopicam* (*i*), are, *Habet & Terra illa maximos & vaſtiſſimos Elephantas ; imo & Taurelephantes, ut vocantur, quorum genus quoad cætera omnia bos maximus eſt, corio verò coloreque elephas, & fermè etiam magnitudine.*

From all theſe ſeveral Writers it appears, that there is in *Æthiopia* (and probably the midland parts of *Africa*, where Travellers ſeldom come) a very large Animal of the *bovinum genus*, at leaſt twice as big as our Bulls or Oxen, with Horns proportionably large, but otherwiſe differing from them in many reſpects. It is true, that in the accounts of uncommon things, given by antient Writers, an allowance muſt ſometimes be made for ſomething fabulous mix'd with what is true, which is the leſs ſurprizing, as they had many things only by hear-ſay : but as to this large ſort of Bulls, it is confirmed by modern Writers, that there is ſuch an Animal in thoſe Countries, though there is none, I know of, that hath given a deſcription of it in the leaſt ſatisfactory. *Ludolf* in

(*g*) Lib. I. c. 10.
(*h*) Lib. III. c. 11.
(*i*) P. 145.

his

his *Hiſtoria Æthiopica*, (*k*) ſays, that there are in *Æthiopia* bulls of an uncommon ſize, twice as large as thoſe in *Hungary* and *Ruſſia*; and that having ſhewn ſome of the largeſt Oxen in *Germany* to *Gregory* an *Abiſſynian*, (from whoſe Writings and informations he collected the Materials for that Work) he ſaid, they were but of a midling ſize. The Letters of the Jeſuits frequently mention the largeneſs of theſe Oxen, and the ſaid *Ludolf* cites the following paſſage out of a Letter of *Alphonſus Mendezius* Patriarch of *Æthiopia*, dated *June* 1, 1626. *Buoi grandiſſimi di corna ſmiſuratamente groſſe é lunghe, talmente, che nella corna di ciaſcuno di eſſe potea capire un otre piccolo di vino*: that is, *very large Oxen, with vaſtly thick and long Horns, one of which would contain a large Uter of Wine.* *F. Bernier*, in his account of the *Great Mogul*'s Country, (*m*) ſays, that among many Preſents, which two *Æthiopian* Ambaſſadors ſhould have preſented to *Aurengzeb*, there was a prodigious large Horn of a Bull, full of Civet, which having been meaſured by him, he found the *Baſis*, or large end, to be half a foot in Diameter. This Horn, as *Bernier* farther obſerves, was brought by the Ambaſſadors to *Dehli*, the place of Reſidence of the *Great Mogul*; but it was not preſented to him, becauſe, being diſtreſs'd for Money, they had ſold the *Civet* out of it, long before they came thither.

Upon the whole, it ſeems to me, that theſe Horns, and likewiſe that mentioned by *Bernier*, are the Horns of a large ſort of Bulls or Cows, in *Æthiopia*, and the

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(*k*) Lib. I. c. 10.
(*l*) Comment. in Hiſt. Æthiop. p. 145.
(*m*) Tome. II. p. 43.

inward

inward parts of *Africa*, which, in all likelihood, is the ſame with that deſcribed by *Agatharchides*, *Pliny*, and thoſe other ancient Writers mention'd above. But I cannot as yet, for want of a more accurate deſcription, be certain, whither it is the ſame with the *Sukotorio*, or *Sukotyro* of *Nieuhof* (*n*), though there is a good deal of reaſon to think, that it is. *Geſſner* (*o*) ſpeaks of a very large Horn, which was hung by a Chain to a Pillar in the *Minſter*, or Cathedral, of *Strasburgh*, and which is not unlikely to be of the ſame ſort with theſe. He ſays, that being meaſured along the outward circumference, it was found to be four *Roman* Yards long, and he conjectures it to have been the Horn of a large old *Urus*, which was hung up there, for its monſtrous ſize, perhaps two or three hundred Years before his time. As to theſe, which are now produced before the *Royal Society*, 'tis very likely, that when the *Engliſh* had a great Commerce at *Ormus*, they were brought thither from ſome neighbouring Country, and afterwards carried over into *England* by ſome curious Perſon.

(*n*) *Loc. ſupra citato.*

(*o*) *Icones Animal. Quadrup. Edit. 2d. Tigur. 1560. p. 34.*

VI. *A Demonſtration of the* 11*th Propoſition of Sir* Iſaac Newton's *Treatiſe of* Quadratures. *By Mr.* Benjamin Robins.

THIS Propoſition conſiſts of two Parts: The firſt is as follows.

Let there be any Curve A D I, whoſe Abſciſſe A B ſhall be denoted by z, and its Ordinate B D by y; which may be related in any manner to the Abſciſſe. And calling this the firſt Curve, let other Curves AEK, AFL, AGM, AHN, &c. be formed to the common Abſciſſe A B, or z, by making the Ordinate B E of the ſecond Curve always equal to the Area A B D of the firſt divided by Unity; the Ordinate B F of the third equal to the Area A B E of the ſecond divided by Unity; the Ordinate B G of the fourth equal to the Area A B F of the third divided by Unity; and ſo on continually. Suppoſe now, that other Curves AOS, A P T, A Q V, A R W, be deſcribed to the ſame common Abſciſſe A B or z; in which Curves the Ordinate B O of the Curve A O S ſhall be equal to $z\,y$, the Ordinate B P of the Curve A P T equal $z^2\,y$, the Ordinate B Q of the Curve A Q V equal to $z^3\,y$, the Ordinate B R of the Curve A R W equal to $z^4\,y$, &c. And let the whole Area A C I be denoted by A, the Area A C S by B, the Area A C T by C, the Area A C V by D, the Area A C W by E, &c. Then the Series of Curves ADI, AEK, AFL, AGM, AHN are thus meaſured:

The

The Area of the firſt Curve ADI is $= A$
——of the ſecond AEK is $= zA - B$
——of the third AFL $= \frac{zzA - 2zB + C}{2}$
——of the fourth AGM $= \frac{z^3A - 3z^2B + 3zC + D}{6}$
——of the fifth AHN $= \frac{z^4A - 4z^3B + 6z^2C - 4zD + E}{24}$

and ſo on perpetually. Here in all the Curves following the firſt, the Index of the higheſt Power of z is always the Number which expreſſes the Diſtance of the Curve from the firſt, and afterwards decreaſes regularly by Unity; the firſt Term is multiplied into A, the ſecond into B, the third into C, the fourth into D, and ſo on; the Coefficients are the ſame as in a Binomial raiſed to the higheſt Power of z, and the Diviſor is ſo many Terms of this Progreſſion $1 \times 2 \times 3 \times 4 \times 5 \times 6$ &c. as is expreſs'd by a Number equal to the higheſt Index of z. Otherwiſe ſuppoſing n to repreſent the Diſtance of the Curve to be meaſured from the firſt; then the Area ſought will be found by extending $\overline{z-1}|^n$ into a Series, and multiplying the firſt Term by A, the ſecond by B, the third by C, the fourth by D, &c. and dividing the whole by $n \times \overline{n-1} \times \overline{n-2}$ &c. continued to Unity.

SECOND PART.

Suppoſing the firſt, ſecond, third, &c. Curves to be the ſame as before: Let t denote the whole Abſciſſe AC, and put x for BC. Then deſcribe the Curves CXA, CYA, CZA, CΓA, where BX ſhall be equal to xy, BY $= x^2y$, BZ $= x^3y$, BΓ $= x^4y$, &c. This being done, and in the Series of Curves CIDA,

CXA, CYA, CZA, CTA, &c. the first Area CIDA being put equal to P, the second CXA equal to Q, the third CYA=R, the fourth CZA=S, the fifth CTA=T, &c. the whole Areas of the aforesaid Series of Curves are also determin'd as follows.

The first AIC=P
The second AKC=Q
The third ALC=$\frac{1}{2}$ R
The fourth AMC=$\frac{1}{6}$ S
The fifth ANC=$\frac{1}{24}$ T.

Here the Area's P,Q,R,S,T are divided by Numbers produced by multiplying as many Terms of this Series $1\times2\times3\times4\times5$ &c. together, as in the former Case.

Demonstration of the First Part.

Let the Area ABD be denoted by *a*, the Area ABO by *b*, ABP by *c*, ABQ by *d*, and ABK by *e*. Then it is evident, that

The Fluxion of the Area ABD is=$\dot{x}\times$BD=$\dot{x}y=\dot{a}$
The Fluxion of the Area ABO is=$\dot{x}\times$BO=$\dot{x}x y=\dot{b}$
The Fluxion of the Area ABP is=$\dot{x}\times$BP=$\dot{x}x^2y=\dot{c}$
&c. &c.

Hence

$x\times\dot{a}$ is $(=\dot{x}xy)=\dot{b}$
$x^2\times\dot{a}$ is $(=\dot{x}x^2y)=x\dot{b}=\dot{c}$
$x^3\times\dot{a}$ is $(=\dot{x}x^3y)=x^2\dot{b}=x\dot{c}=\dot{d}$.

Or generally,

$x^n\times\dot{a}=x^{n-1}\times\dot{b}=x^{n-2}\times\dot{c}=x^{n-3}\times\dot{d}$, &c.

Now

Now as $\dot{z} \times$ ABD or $\dot{z} \times a$ is $=$ Fluxion of ABE, if you add to the firſt Part $z \times \dot{a}$ $(= \dot{z} z y)$ and its Equal $\dot{b}$ to the other Part, it follows, that

$$\left.\begin{matrix} \dot{z} \times a \\ + z \times \dot{a} \end{matrix}\right\} = \text{Fluxion of ABE} + \dot{b}$$

And taking the Fluents
$z \times a = \text{ABE} + b$ or $\text{ABE} = z \times a - b$; and when z or AB becomes $=$ AC, then ABE becomes ACK, and a and b become A and B; therefore ACK is $= z \times \text{A} - \text{B}$.

Again, The Ordinate BF of the next Curve is equal to ABE, which has been proved equal to $z \times a - b$. Conſequently the Fluxion of ABF is $= \dot{z} z a - \dot{z} b$; and if you add to the firſt Part of this Equation $\frac{1}{2} z^2 \times \dot{a} \div \dot{z} b$ $(= \frac{1}{2} z^2 \dot{z} y - \dot{z} z^2 y = - \frac{1}{2} \dot{z} z^2 y)$ and its Equal $- \frac{1}{2} \dot{c}$ on the other, it follows, that

$$\left.\begin{matrix} \dot{z} z a - \dot{z} b \\ + \frac{1}{2} z \dot{z} a - z \dot{b} \end{matrix}\right\} = \text{Fluxion of ABF} - \frac{1}{2} \dot{c}$$

And taking the Fluents
$\frac{1}{2} z^2 a - z b = \text{ABF} - \frac{1}{2} c$; or by tranſpoſing
$\text{ABF} = \frac{z^2 a - 2 z b + c}{2}$; or ſuppoſing z equal to AC,
$\text{ACL} = \frac{z^2 \text{A} - 2 z \text{B} + \text{C}}{2}$.

The Ordinate BG is equal to ABF, which has been proved equal to $\frac{z^2 a - 2 z b + c}{2}$. Therefore the Fluxion of ABG is equal to $\frac{z \dot{z}^2 a - 2 z \dot{z} b + \dot{z} c}{2}$

And

And adding $\frac{1}{6} z^3 a - \frac{1}{2} z^2 b + \frac{1}{2} z c$ $(= \frac{1}{6} z z^3 y - \frac{1}{2} z z^3 y + \frac{1}{2} z z^3 y = \frac{1}{6} z z^3 y)$ on one side, and its Equal $\frac{1}{6} d$ on the other, it will be

$$\left.\begin{array}{l} \frac{1}{2} \dot{z} z^2 a - \dot{z} z b + \frac{1}{2} \dot{z} c \\ + \frac{1}{6} z^3 \dot{a} - \frac{1}{2} z^2 \dot{b} + \frac{1}{2} z \dot{c} \end{array}\right\} = \text{Fluxion of } ABG + \frac{1}{6} \dot{d}$$

And taking the Fluents
$\frac{1}{6} z^3 a - \frac{1}{2} z^2 b + \frac{1}{2} z c = ABG + \frac{1}{6} d$; and transposing, $ABG = \frac{z^3 a - 3 z^2 b + 3 z c - d}{6}$; or supposing z equal to AC; then $ACM = \frac{z^3 A - 3 z^2 B + 3 z C - D}{6}$.

In the same manner the Fluxion of ABH is equal to $\frac{\dot{z} z^3 a - 3 \dot{z} z^2 b + 3 \dot{z} z c - \dot{z} d}{6}$; and adding on one side $\frac{1}{24} z^4 \dot{a} - \frac{1}{6} z^3 \dot{b} + \frac{1}{4} z^2 \dot{c} - \frac{1}{6} z \dot{d}$, and its Equal $- \frac{1}{24} \dot{e}$ on the other, it becomes

$$\left.\begin{array}{l} \frac{1}{6} \dot{z} z^3 a - \frac{3}{6} \dot{z} z^2 b + \frac{3}{6} \dot{z} z c - \frac{1}{6} \dot{z} d \\ + \frac{1}{24} z^4 \dot{a} - \frac{1}{6} z^3 \dot{b} + \frac{1}{4} z^2 \dot{c} - \frac{1}{6} z \dot{d} \end{array}\right\} = \text{Fluxion of } ABH - \frac{1}{24} \dot{e}$$

And taking the Fluents
$\frac{1}{24} z^4 a - \frac{1}{6} z^3 b + \frac{1}{4} z^2 c - \frac{1}{6} z b = ABH - \frac{1}{24} e$: therefore $ABH = \frac{z^4 a - 4 z^3 b + 6 z^2 c - 4 z d + e}{24}$;
Or $ACN = z^4 A - 4 z^3 B + 6 z^2 C - 4 z D + E$, supposing z equal to AC. In like manner you may proceed to measure any of these Curves: and you will always find their Value the same as is expressed in the Proposition.

De-

Demonſtration of the Second Part.

Suppoſe any Curve whoſe Diſtance from the firſt is denoted by n; then the Curve whoſe Abſciſſe is BC or x, and its Ordinate $x^n y$ divided by $n \times \overline{n-1} \times \overline{n-2} \times \overline{n-3}$ &c. continu'd to Unity will be equal to it, when x is equal to AC or t.

It is evident, that when the Areas ABD, ABO, ABP, ABQ, ABR, &c. decreaſe, the Areas BCID, BCSO, BCTP, BCVQ, BCWR increaſe reſpectively; and conſequently the Decrements of the Areas ABD, ABO, ABP, &c. or their Fluxions with a negative Sign, are the Increments or Fluxions of the Areas BCID, BCSO, BCTP, &c. that is, calling the Area BCID, α; the Area BCSO, β; the Area BCTP, γ; BCVQ, δ; BCWR, ε: then $\dot{\alpha} = -\dot{a}$, $\dot{\beta} = -\dot{b}$, $\dot{\gamma} = -\dot{c}$, $\dot{\delta} = -\dot{d}$, $\dot{\varepsilon} = -\dot{e}$.

Now the Fluxion of the Curve, whoſe Abſciſſe is $= x$, or BC, and its Ordinate $= x^n y$ is $\dot{x}\, x^n y$; that is, equal to $\dot{x}\, y \times \overline{t-z}|^n$; x being $= t - z$; or ſince the Increment of x, or $\dot{x}$ is equal to the Decrement of z, or $-\dot{z}$, the Fluxion of the ſame Curve is equal to $-\dot{z}\, y \times \overline{t-z}|^n = -\dot{z}\, y$ in $t^n - n \times t^{n-1} z + n \times \frac{n-1}{2} t^{n-2} \times z^2$ &c. $= -t^n \dot{z}\, y + n t^{n-1} z \dot{z} y - n \times \frac{n-1}{2} t^{n-2} \dot{z} z^2 y$, &c.

that is, $= t^n \times -\dot{a} - n t^{n-1} \times -\dot{b} + n \times \frac{n-1}{2} t^{n-2} \times -\dot{c}$, &c.

or $= t^n \dot{\alpha} - n t^{n-1} \beta + n \times \frac{n-1}{2} t^{n-2} \dot{\gamma}$, &c. and taking the Fluents, the Area of the Curve, whoſe Abſciſſe is x, or BC, and Ordinate $x^n y$, is equal to $t^n x - n t^{n-1} \beta + n \times \frac{n-1}{2} t^{n-2} \gamma$ &c. But when x is equal

to

to AC, then α, β, γ, &c. will be equal to A. B, C, &c. as is very evident; conſequently the Area of the Curve whoſe Abſciſſe is x, and Ordinate $x^n y$, when x is = AC, is $t^n A - nt^{n-1} B + n \times \frac{n-1}{2} \times t^{n-2} C$ &c. that is equal to $\overline{t-1}|^n$ thrown into a Series, and the firſt Term multiplied by A, the ſecond by B, the third by C, &c. But $\overline{t-1}|^n$ thrown into a Series, and the firſt Term multiplied by A, the ſecond by B, the third by C, &c. and then the whole divided by $n \times \overline{n-1} \times \overline{n-2}$, &c. continued to Unity, is equal to the Area of the Curve, whoſe Place in the Series is denoted by n: Therefore the Area of the Curve, whoſe Abſciſſe is equal to x, and its Ordinate to $x^n y$, taken when x is equal to AC, and divided by $n \times \overline{n-1} \times \overline{n-2} \times \overline{n-3}$ &c. continued to Unity, is equal to the Area of a Curve whoſe Place in the Series is denoted by n; that is, Q, which is the Area of a Curve, whoſe Abſciſſe is x, and Ordinate $x y$ taken when x is = AC, is equal to the ſecond Curve AKC; half R, which is the Area to the Abſciſſe x, and Ordinate $x^2 y$, taken in the ſame manner, is equal to the third Curve ALC; $\frac{1}{3}$ S, which is a like Area to x and $x^3 y$, is equal to the fourth Curve AMC; $\frac{1}{24}$ T, the Area to x and $x^4 y$, x being equal to AC, is equal to the fifth Curve ANC; and ſo on perpetually Q.E.D.

VII. *Muris*

VII. *Muris Alpini Anatome.* *A* Joh. Jacobo Scheuczero, Tigurino, *M. D. R. S. S.*

RElictis abdominalibus muſculis, aperto abdomine, in conſpectum venit illico omentum pingue admodum, cujus tractus pinguedinoſi vaſis ſanguiferis epiploicis intertexti pulcherrimum formant rete; ſed eſt hæc omenti pinguedo concreta magis & compactior ea, quæ mox deſcribenda venit, ac veluti emaciata, ut omninò judicare liceat, reſorptas eſſe per hyemem durante ſomno fluidiores oleoſi hujus liquidi partes per venam portæ, ut inſervirent tum ſecretioni bilis, quâ veſica bilaria fuit admodum turgida, tum nutrimento ipſius corporis.

Ex utroque hypogaſtrii latere copioſiſſima conſpicitur & laxioris, quàm illa omenti, conſiſtentiæ pinguedo, quæ inde à renibus ſeſe protendit ad inguen, formans veluti alterum, imò duplex omentum, quæ pinguedo, uti & illa meſenterii, quæ ductum inteſtinorum omnium comitatur, adeſt tum ad lubricanda viſcera abdominalia, tum in ſucci nutritii amplum penuarium.

Ad duodeni latus pro more, imò ultra ejus curvaturam, ſeſe protendit pancreas, idque valde extenuatum, in quo macilentiæ ſtatu vidimus omnes alias corporis glandulas, ſpeciatim eas, quæ muſculis interjacent; in his animantibus tardiſſima eſt ſanguinis circulatio, tardiſſimæ omnes corporis ſecretiones, nulla interim ſeri vel lymphæ, quæ tardam quidem, ſed tamen ſucceſſivam habet ſecretionem, revectio, ut tandem ſanguis omni penè ſero orbetur; hinc non mirum, quod

deficiente lympha ſecernenda, glandula pancreatis, & ſic quoque aliæ debeant emaciari.

Aperto duodeno in conſpectum prodit bilis ſpumoſa, quæ ipſa indicat ſeri defectum.

In fœmella hac uteri cornua ſeſe protendunt ad duos pollices Pariſinos, tubæ pertenues filo vix craſſiores ad $\frac{1}{3}$ pollicis, ovaria 2 lineas circiter longa, unam lata, alba, ſub microſcopio pellucida, cum prominentibus ovulis diſtinctæ diaphaneitatis.

Hepatis ſatis magni lobi ſunt ſex, & aliqui horum in duos veluti ſubdiviſi per inciſuram: Lobo infimo mediante membrana connectitur cum rene dextro.

Renes pinguedine toti ſunt obſiti.

Renes ſuccenturiati ad latus venæ cavæ ſupra emulgentes corpuſcula ſunt flavicantia tres circiter lineas longa vix dimidiam lata, hepar inter & renes conſpicua; ſed uti aliæ glandulæ, macilentæ.

Ventriculi ſtructura eſt, uti in animalibus aliis prohibitis & carnivoris, ſimplex membranoſa, licet hoc animal ſit herbivorum, figura ejus extat litera *A*.

Singularis ſtructuræ eſt fiſtula inteſtinalis in confinio inteſtinorum tenuium & craſſorum.

Ingreſſus ilei in colon in diametro habet duntaxat tres lineas; colon è regione ilei 2 lineas. Sed quod incurvatur ibidem cœcum, eſt ex ampliſſimis, 2 pollicum in diametro. Memorabilis eſt valvula coli dicta, annuli ad inſtar rotunda, ſingularis prorſus ſtructuræ. Exilis quippe admodum eſt.

Ingreſſus ilei veluti inter duas tunicas conniventes, ita ut nullus prorſus concedi poſſit excrementis ad inteſtina tenuia regreſſus. Et membranæ duæ, quæ mutuo occurſu valvulam illam formant, rhomboidalis ſunt figuræ. Adſunt præterea aliæ valvulæ conniventes annulares, & veluti in ramos protenſæ tres quatuorve principales verſus inteſtinum cœcum. Illuſtrat hæc ob-

obſervatio egregie uſum inteſtini cœci, quod in infantibus recens natis ordinariè eſt capacius. Inſervit nempe id diverticuli loco excrementis per novem menſium decurſum in inteſtinis colligi, nec per ea excerni ſolitis. Par hic eſt ratio animantium, quæ per hyemem integram in montium cavernis dormiunt. Nulla per illud tempus fit excrementorum egeſtio, & tamen non obſtante hâc tardiſſimâ circulatione atque ſecretione, nullâve ciborum aſſumptione, collectio fit eorundem, quæ ne inteſtina utriuſque generis infarciant nimium, amandantur ad cœcum, ibique ad uſque vernum tempus manent; regreſſus autem ex eodem ad colon impeditur imprimis per valvulas ante deſcriptas. Structuram hanc inteſtinorum memoratorum integram oculis exhibet figura B ; valvulæ autem coli & aliarum conniventium fig. C. Ex myographia ea imprimis contemplanda duximus, quæ actiones hujus animalis diſtinguunt ab aliis aliorum. Immediatè ſub cute craſſus eſt & fortis muſculus platyſma myoides dictus, qui colli partem anteriorem & lateralem, imò & totum muſculum maſſeterem faſciæ inſtar involvit. Ad ipſam uſque articulationem humeri cum cubito ſe protendens labio tum inferiori, tum ſuperiori inſeritur, & motum frequentem pedum anteriorum flexorium ſimul & labiorum inſigniter adjuvat. Hæc quippe Animalia cibos pedum anteriorum beneficio, veluti manibus apprehendentia, ori admovent, & terram illorum ope ſuffodiunt.

Glandulæ thyroideæ ad laryngis latera magnæ, haud dubiè ad irrigationem muſculorum vicinorum, quorum uſus admodum eſt frequens, quem ipſum in finem paſſim aliis muſculis interjacent alia corpora glanduloſa paſſim memoranda.

Sternohyoideus & ſternothyroideus in ordinario ſunt ſitu.

Fortiſſimus & tendinoſus valde eſt maſſeter, maximi in his animalibus uſus.

Fortiſſimus item depreſſor maxillæ inferioris digaſtricus, qui baſi oſſis hyoidis & ejus cornibus forti item tendine à proceſſu ſtyloide ortus in maxillam inferiorem ad mentum ferè uſque inſeritur, cujus venter anterior imprimis eſt craſſus & poſteriori quadruplo fortior.

Loco geniohyoidei externi adeſt ſtatim ſub mento maſſa carnea muſculoſa craſſa, triangularis inde à maxillæ inferioris concurſu, ſive angulo, ſeſe in quinque lineas lateraliter protendens, quæ maxillam inferiorem imprimis connectere videtur. Poſt hunc baſi linguæ inſternitur muſculus latus tranſverſis fibris carnoſis à maxillæ inferioris parietibus internis ortus, qui tum in mediam linguæ baſin, tum in os hyoides inſeritur; qui etiam ſupplere videtur geniohyoideum externum. Tenuis ille eſt & à ſubſtrato geniohyoideo interno, ſive genioglosſo vix ſeparandus.

Styloglosſus fortis quoque eſt muſculus, carnoſoque principio à proceſſu ſtyloide ortus in fortem deſinens tendinem.

Conſpicui valde ſunt muſculi cricothyroidei item hyrohyoidei.

Ad latera gulæ & aſperæ arteriæ glandulæ ſunt utrinque ad digiti ferè longitudinem protenſæ, quæ nonniſi elevata aſpera arteria & gula in conſpectum veniunt, & lubricandis his partibus inſervire videntur.

Fortis eſt muſculus rectus anticus major ejuſdem planè ſtructuræ uti in homine.

Ceratohyoides triangularis muſculus à cornibus oſſis hyoidis ortus in baſin ejus inſeritur.

Thy-

Thyroarytænoideus ſub ſphinctere gulæ conſpicuus ad id ſpeciatim inſervit, ut clangorem his animalibus proprium efficiat conſtringendo fortiter Arytænoideas cartilagines.

Muſculi pterygoidei ſunt admodum fortes.

Ad ſupra jam deſcriptum platyſma myodes adnotandum porro, portionem craſſam ſatis inſeri ſpinæ ſcapulæ, ſed quoque eidem muſculo tranſverſim implantari alium tenuem trapezio inſtratum, qui proin integer ex variis partibus coadunatus muſculus inſervit motui labiorum, flectendo cubito, levandæ ſcapulæ & antrorſum ducendis brachiis, quorum opera hæc animalia terram ſuffodiunt, aliaſque res ſuas peragunt.

Trapezius eodem prorſus modo ſe habet ut in homine.

Rhomboidis loco adeſt muſculus fortis ſub trapezio in conſpectum veniens, qui oritur non ſolum à ſuperioribus ſpinis vertebrarum dorſi, & inferioribus colli, ſed omnibus omninò ſpinoſis tranſceſſibus vertebrarum colli, & inſuper ab occipite, ita ut ſcapulam non ſolum retrorſum moveat, ſed etiam elevet, ſicque patientiæ muſculum in actione ſua adjuvet.

Inſertio hæc rhomboidis in occiput obſervatur quoque in quadrupedibus aliis, & haud dubiè eum in finem adeſt, ut caput pronum pendens tanto melius ſuſtineatur.

Patientiæ muſculus tenui principio oritur ab apophyſi tranſverſa primæ vertebræ, & in principium ſpinæ ſcapulæ inſeritur.

Hujus actionem adjuvat alius eodem principio ortus, qui ad finem ſpinæ dictæ inſeritur, qui duo proin junctim ſumpti totam ſcapulam attollunt.

Serratum inter anticum majorem, qui eodem modo ſe habet uti in homine, & ſubſcapularem adeſt glanduloſa caro magna & lata fortibus his muſculis lubricandis inſerviens.

Serratus anticus major non ſolum dentatas habet origines à coſtis, ſed etiam fortes & craſſas propagines arceſſit à proceſſibus tranſverſis vertebrarum colli.

Aniſcalptor adeſt duplex unus alteri inſtratus, inferior & latior atque fortior dentatis veluti proceſſibus ab ipſis coſtis, imprimis inferioribus oritur, & inferiori ſcapulæ coſtæ in tranſitu firmiter annexus lata ſatis baſi humero uti in homine inſeritur, & præterea propaginem mittit tenuem ad ipſum olecranon, ita ut non ſolùm humerum retro deorſum trahat, ſed etiam cubiti extenſioni inſerviat.

Muſculi humeri infraſpinatus, ſubſcapularis, & rotundus uterque eodem modo ſe habent uti in homine.

Deltoides duplex eſt. Ea pars, quæ oritur à clavicula & acromio in flexuram cubiti inſeritur, adeoque non tam ad humeri, quàm ad cubiti muſculos pertinet; altera verò portio, quæ ab acromio & ſpina ſcapulæ oritur, exteriorem humeri ſitum obtinet in medium circiter humerum inſerta; hunc proin non ſolùm ſurſum movet, ſed & extrorſum abducit.

Coracobrachiæus tenuis eſt muſculus ejuſdem ſitus & uſus ut in homine.

Inter extenſores cubiti primus eſt tenuis, reliquiis faſciæ ad inſtar inſtratus, à coſta ſcapulæ ortus; ſequuntur duo alii fortes, quorum unus etiam à coſta ſcapulæ oritur, alter à ſuperiore parte humeri, qui aliquandiu progreſſi ſeſe uniunt & forti tendine in olecranon inſeruntur.

Sub his alius latet itidem fortis, qui à ſumma humeri parte ortus cum anconæo ſeſe unit.

Hic

Hic ipſe autem fortior & craſſior eſt, quam in homine, & exterius atque inferius humeri latus occupat.

Inter flexores cubiti biceps ejuſdem eſt ſtructuræ uti in homine.

Brachialis verò interni origo ſeſe protendit ad capitulum uſque humeri, & in ſuo progreſſu hic muſculus totam humeri externam partem veluti faſciatim ambit, & eodem loco uti in homine inſeritur.

Flexores carpi adſunt tres ; Extenſores carpi tales ſunt, quales in homine.

Extenſores digitorum ſunt primò communis, qui in tres digitos priores inſeritur ab humero ortus. Secundus cubito deſcendens, in ultimum & penultimum inſeritur.

Adeſt & indicator ſ. extenſor indicis.

Pronatores ſe habent uti in homine.

Ex ſupinatoribus longus brevior eſt brevi, cæterum ejuſdem ſitus uti in homine.

Aliorum muſculorum deſcriptiones reſervamus in aliud tempus.

Figurarum Explicatio.

Fig. 5. A B. Gula, C D. Duodenum, E. Ventriculus.

Fig. 6. E H. Ilei portio, G. H. Coli portio, H F I. Cœcum omnia magnitudine naturali.

Fig. 7. *a a* Coli valvula, prorſus fere uti depingitur in homine, niſi quod fermè ſit rhomboidalis ; *b c* Apertura Ilei in Colon.

Fig. 8. K. Portio Cœci, cujus ima pars eſt aperta versùs Colon, ut Valvulæ conniventes ramoſæ o o o in conſpectum veniant.

ERRATA.

Page 223. line 23. r. *Fig.* 2. ibid. lin. 31. r. *Fig.* 3.

FINIS.

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PHILOSOPHICAL TRANSACTIONS.

For the Months of *April*, *May*, and *June*, 1727.

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I. *Obſervations on the* Lumen Boreale, *or* Streaming *on* Oct. 8, 1726, *by the Reverend Mr.* W. Derham, *F. R. S.*

ALthough the *Lumen Boreale*, or *Streaming* hath been a common Phænomenon, ever ſince the ſurpriſing one, *Mar.* 6, 1715, 16, and as ſuch, would not deſerve to be taken notice of; yet in this of *Oct* 8, there were not only ſuch ſurpriſing, but different Circumſtances, that, I hope, the Royal Society will receive Accounts of them from many Hands; which may enable the skilful Meteorologiſts to find out their Cauſe.

For the clearer proceding in my Relation, I ſhall obſerve, that there are two ſorts of *Streamings*, which I have taken notice of; one, by way of *Exploſion* from the Horizon; the other, by *opening* and *ſhutting*; without ſuch Shootings up, and ſwift Dartings, as thoſe were which appeared in the *Lumen Boreale* before ſpoken of.

Of the latter ſort chiefly, was this laſt of *Oct* 8: in which, altho' the *Streams*, or *Spires*, or *Lances* or *Cones* (or, what ſhall I call them?) were as large and remarkable as in the former; yet they exhibited themſelves principally by the vaporous Matter opening and ſhutting, as if a Curtain had been drawn and withdrawn before them.

The firſt View I had of this Phænomenon, was preciſely at Eight o'Clock in the Evening: At which time, all I ſaw, was a long narrow *Faſcia*, like a white ragged Cloud, extended croſs the Heavens, from

W. b. S. to E. b. N. which in a few Minutes began to emit ſome Streams, and then diſappear'd: Which was ſucceeded by much Streaming in the Northerly Parts; and in a quarter of an Hour it began to reach other Points alſo; and ſoon after that, it ſtreamed all round in the Southerly, Eaſterly and Weſterly Parts as much, or nearly as much as in the North. Which was a thing I never had ſeen before in theſe Phænomena.

Fig. 1. Theſe *Streams*, or *Cones*, were for the moſt part pointed, ſo as to make the Appearance of *flaming Spires*, or *Pyramids*; and ſome others were truncated, and reach'd but half way: Some alſo were longer, and ſome ſhorter; ſome of which had their Points reaching up to the Zenith, or near it, where they formed a ſort of *Canopy*, or thin Cloud, ſometimes red, ſometimes browniſh, ſometimes blazing as if fired, and ſometimes emitting Streams all round it, which at that time gave it the appearance of ſuch a Star as our Knights of the Garter wear on their Breaſts.

This *Canopy* was manifeſtly formed by the Matter carried up by the Streaming on all parts of the Horizon: Which Matter ſometimes ſeem'd to aſcend with ſome force, as if impell'd by the Impetus of ſome exploſive Agent below, as I have ſaid it was in the Streaming of *March* 1715, 16, and which I gave the Society a large and particular Account of ſoon after. This forcible Aſcent of the ſtreaming Matter, gave a Motion to the Canopy, ſometimes a Gyration, like that of a Whirlwind; which was manifeſtly cauſed by the Streams ſtriking the outſide Parts of the Canopy, as in the Figure: But when the ſtreaming Matter hit the Canopy in the Middle, all was then in Confuſion.

Theſe

Theſe two Partieulars, namely, the *Streaming all round*, in all Points of the Horizon; and the *Canopy* in and near the Zenith, are what were taken notice of in all Parts of *England*, that I have met with any Accounts from; particularly, in *Northamptonſhire*, *Staffordſhire*, *Oxfordſhire*, *Wiltſhire*, *Berkſhire*, *Middleſex*, *Somerſetſhire*, and *Eſſex*, and in divers Parts beyond Sea.

The Reverend and Learned Mr. *Waſſe* gives me this Account of its Appearance at *Aynho* in *Northamptonſhire*, That at 7 h. 20′ p. M. he ſaw an Arch ſomewhat curved, like a Rainbow at firſt, and about half the Breadth of the Rainbow, and yellow; which in about ten Minutes began to twiſt, and make an Angle at the Zenith: That one End of it was pretty much to the Eaſt, and not directly to the North; and the Weſtern End deflected as much to the South: That it remained after the Twiſt, at the Zenith, without any great Motion, not a quarter of an Hour. After which, the Rods aroſe on all ſides, from the Horizon to the Zenith, the upper Points ſeeming to move thro' a ſort of Vortex quite out of our Atmoſphere: Which Rods, he thinks, roſe perpendicularly from the Horizon, but ſeemed to converge towards the Zenith, according to the Rules of Perſpective, by their Angle then being leſs than their Baſis at the Horizon: That a Redneſs was perceived, which, he thinks, was ſtrongeſt towards the Weſt; which Colour did not appear till the Arch brake into ſeveral Pieces, and overſpread the Heavens with a thin faintiſh Fire, thro' which they ſaw *Jupiter* very clearly.

This Account of Mr. *Waſſe*'s may ſhew, how the Phænomenon was in *England*; by reaſon moſt of the

Accounts I have met with, concur in the main with his. But in the more Southerly Parts of *Europe*, I take it to have been ſomewhat different. The News-Papers tell us from *Scaffhauſen*, that on the *19th* of " *October* there was a great Alarm in many Parts of " *Switzerland*, on account of a great *Light* ſeen in " the Air, from 7 o'Clock till Midnight; which was " ſuppoſed to be the Reflection of ſome great Con- " flagration. At *Bern*, every body thought there " was a Fire in ſome part or other of the City or " Neighbourhood. At *Neufchatel*, the Alarm-Bells " were rung, and the Governour ſeveral Hours on " Horſeback, to give Orders, *&c.* as in Caſes of " Diſtreſs. All which they heard afterwards, was " only an *AuroraBorealis*." And from *Florence*, my ingenious and curious Friend Sir *Tho. Dereham* ſent me this Account, " As to the *Lumen Boreale*, which appear'd in " theſe Parts on *Oct. 8th* laſt, I ſaw it my ſelf in the " following manner: It was one Hour and half after " Sun-ſet, when I was paſſing thro' a Piazza in this " Town, that I diſcover'd the Phænomenon, that " ſeem'd one Mile long, and three quarters of a Mile " broad, of an almoſt perfect Oval Figure, hanging " North and North-Eaſt to us: The Edges of it were " of pale light Colour, like the firſt Dawn of the " Morning; and towards the Center, it encreas'd its " fiery Colour; ſo that in ſome Places it look'd as the " Fire of a Furnace; but in the very Center, and many " adjacent Parts, it was like a red-hot Iron growing " cold, that ſeems bloody. For a good while I could " perceive no Motion in it; but after a quarter of an " Hour, I diſcover'd a general ſlow Motion backwards " and forwards, like that one ſees of the Circulation " of the Blood in the Tails of Fiſhes, by the help of " the Microſcope, but no manner of Darting; inſo-

" much

" much that in another quarter of an Hour it vaniſh-
" ed imperceptibly, juſt as a Rainbow, and the Air
" grew dark again, that was ſo luminous before, that
" one might read a Manuſcript by the ſame. It is
" very remarkable, that at *Fieſole*, a Town with-
" in a ſhort Mile of this, the Phænomenon ſeem'd to
" thoſe Inhabitants, to be between them and us, and
" they thought our Town was burning: Whereby it
" appears not to have been very deep, nor very high;
" *Fieſole* ſtanding upon a Hill half a Mile high, and
" to the North-North-Eaſt of this Town.

To theſe Obſervations of my ſelf, and ſome of my Correſpondents, I ſhall add two or three things more, before I enquire into the Cauſe of the Phænomena.

One thing that was taken notice of in moſt Places, was, That in ſome part of the greateſt Streaming, the Vapours between the Spires, or Lances, were of a Blood-red Colour. That which I obſerv'd, was, That about half an Hour after Eight o'Clock, the Vapours towards the South-Weſt were very denſe, and for ſome time red. And not long after, the like Redneſs aroſe in the North-Eaſt, and the other gradually went off. Both which gave thoſe Parts of the Atmoſphere the Appearance of blazing Lances, and bloody-colour'd Pillars.

Another thing I took notice of, was, a ſtrange Commotion, and Working among the Streams, as if ſome large Cloud, or other Body was moving behind them, and diſturb'd them.

In the Northerly and Southerly Parts the Streams were perpendicular to the Horizon; but in the intermediate Points they ſeem'd to decline more or leſs one way or other; or rather to incline towards the Meridian.

As

As for the *Weather*, the preceding Day was cloudy, with an Hoar-Froſt in the Morning; but it clear'd up, and grew warmer afterwards; but towards the Horizon, very vaporous. And the next Morning (after the Streaming) before Sun-riſing, the Air was full of Vapours, with divers thin vaporous Clouds, ſome of a lucid brown, ſome reddiſh, which I took to be Remains of the Streaming, which, I was informed, continued all Night.

As for the Cauſe of theſe Phænomena, I take it to be from the ſame Matter, or Vapours, which produce Earthquakes: And that for theſe Reaſons: *Firſt*, Becauſe ſome of theſe Phænomena have been followed by Earthquakes As that which *Stow* gives an Account of in his *Annals*, in the Year 1574, on *Nov.* 14. in which he ſaith, *were ſeen in the Air ſtrange Impreſſions of Fire and Smoak to proceed forth of a black Cloud in the North towards the South.* That *the next Night following, the Heavens from all parts did ſeem to burn marvellous ragingly, and over our Heads the Flames from the Horizon round about riſing did meet, and there double and roll one in another, as if it had been in a clear Furnace.*

And after this (he tells us) *followed on the* 26th *of* February, *great Earthquakes in the Cities of* York, Worceſter, Glouceſter, Briſtol, Hereford, *and in the Countries about, which cauſed the People to run out of their Houſes, for fear they ſhould have fallen on their Heads. In* Tewksbury, Breedon, *&c. the Diſhes fell from the Cupboards, and the Books in Mens Studies from the Shelves:* With more to the ſame purpoſe.

So this laſt (in *October*) was preceded by that fatal Earthquake at *Palermo* in *Sicily*, and ſucceeded by one in *England*, on *Tueſday*, *October* 25, following. This, I hear, was perceived in *London*, and was very conſiderable

derable at *Dorcheſter*, *Weymouth*, *Portland*, *Portſmouth*, *Purbeck*, and divers other Places in *Dorſetſhire*, that it cauſed the Doors to fly open, ſhook down Pewter off the Shelves, and was felt in ſome Ships that lay in the Harbours.

2. Another Reaſon is, That I am aſſur'd by an ingenious ſenſible Gentleman of my Acquaintance, that as he was viewing this Appearance, on the Top of his Houſe at *Little Chelſea*, he plainly perceived a Sulphureous Smell in the Air; and that another Perſon did the ſame, on the Top of another Houſe near him.

3. Another thing which concurs with what hath been ſaid, is, That I am aſſured from ſeveral Perſons, that an Hiſſing, and in ſome Places a crackling Noiſe was heard in the time of the Streaming, like to what is reported to be often heard in Earthquakes.

And now, for a Concluſion, I ſhall remark two things upon what hath beed ſaid.

1. That it may help the ſagacious Meteorologiſt to reſolve ſeveral Difficulties relating to theſe *Northern Lights*, to obſerve, that what was *Streaming* or *Darting* in our Northern Parts, was only a remarkable Light, or Blaze in *Italy*, and the Southern Parts, if I take Sir *T. Dereham*'s and the News-Papers Accounts right.

2. If thoſe Phænomena have the ſame Origine that Earthquakes have, that then they are, doubtleſs, of great uſe to the Peace and Safety of the Earrh, by venting ſome of that pernicious Vapour and Ferment that

that is the Cauſe of thoſe terrible Convulſions, which Earthquakes are accompanied with.

I forgot (when I deſcribed the *Canopy* or *Corona*) to ſay, that it did not reſt in one place; but changed its Poſition, ſometimes higher near the Zenith, and then towards the Eaſt, and South-Eaſt, 10 or 15 Degrees, and then back again nearer the Zenith, according as the darting Matter directed it: But I do not remember, that this Canopy was at any time directed towards the Weſtern Points.

In moſt of the *Northern Lights* that I have ſeen, there generally was a dark Bank of Vapours, circular on the Top; but whether this of *Oct.* 8, had any ſuch Arch, I could not ſee at *Upminſter*, where I was ſurrounded with Trees.

II. *The ſame obſerv'd at* Southwick *in* Northamptonſhire. *By* George Lynn, *Eſq;*

	Barom. Alt.	*Therm*	*Wind*	
Oct. 8, 10, Morn.	29. 90	54.	W. 1.	Weather fair and clear.

THIS Evening appear'd an *Aurora Borealis*, I think, full as remarkable as that in *Mar.* 1716, tho' varying in Form: It began about Six at Night to be light in the North, with Streaks proceeding from it, and ſpread gradually both towards the Eaſt and Weſt, the South being ſtill very clear; but before Seven it left all the Northern Parts (except towards the Zenith) and cover'd all the Southern. Soon after which, there appear'd a white Arch proceeding from Eaſt to Weſt, paſſing near the Zenith, but more South, which ſeemed fix'd for a time; but about 10 Minutes paſt Seven was diſperſed, and immediately ſucceeded by a kind of Glory of an Oval Form, the longer Axis from Eaſt to Weſt, ſomething South of the Zenith, with Rays ſhooting up from all parts, and interchanging ſwiftly, for about 15 or 20 Degrees from it; the reſt of the Heavens (except the North, which ſtill continued very clear) affording various Phænomena. In the Eaſt there was a quick Succeſſion of Columns of the *Iris* Colours, inclinable to White, the Weſt to Purple, and about the South-Weſt, for a good ſpace, appeared almoſt a blood red Coruſcation, which continued 5 or 6 Minutes.

Theſe Appearances in a quarter of an Hour became leſs remarkable; though the *Aurora* continued moſt of the Night, and afforded a Light generally equal to the Moon in its Quadratures. Looking with my Teleſcope at *Jupiter*, I found both his Satellites and Belts appear as plain thro' the *Aurora*, as if the Sky had been perfectly clear.

III. *Regiſtrum*

III. *Regiſtrum Obſervationum de Lumine Boreali per quadriennium. Ex Epiſtola Viri Cl.* Gulielmi Raſtrick, *ad* Martinum Folkes, *Arm. R. S. V. Pr.* Lennæ Regis, Martii 20, $172\frac{6}{7}$.

MItto tibi, Vir Ampliſſime, Regiſtrum breve Obſervationum de *Luminibus Borealibus*, per quadriennium alterum (videlicet ab anno 1722,) à me continuatum. Neſcio profectò an in ulla re dignum ſit tua cognitione; ſed qualecunque eſt, judicio tuo & candori refero. Sum

&c.

GULIELMUS RASTRICK.

Die Martis, *Feb.* 19, 1722,3, hora ſeſquidecima.

Die Veneris, *Martii* 15, 1722,3, ab hora octava, ad mediam uſque noctem.

Die Martis, *Aug.* 20, 1723.

Die Dominica, *Oct.* 20, 1723, ab hora ſexta, ad mediam noctem.

Die Dominica, *Sept.* 26, 1725, Aurora Borealis viſa eſt ab hora ſeptima, ad horam decimam, cum Radiationibus variis.

Die Lunæ, *Oct.* 3, 1726, per totam noctem.

Item Die Martis, *Oct.* 4, 1726.

Itemque Die Saturni, *Oct.* 8, 1726, per totam noctem. Mirum sanè Phænomenon, de quo nihil dixi, quia tam accuratè describitur à Dominis *Langwith*, *Huxham*, *Hallet*, *Hadley*, & *Johan. Ludov. Calandrino*, in *Actis Londinensibus*, N°. 395.

Die Mercurii, *Oct.* 26, 1726, circa horam decimam.

Die Veneris, *Martii* 3, 1726,7, ab hora octava, ad mediam noctem. Aurora hac nocte (ut mihi videbatur) longè mirabilior fuit illâ *Oct.* 8; & credo equidem, nullatenus discrepavit (secundum descriptiones quas habemus) ab illo memorabili Phænomeno, sexto *Martii*, 1715,16.

Item Die Domin. *Martii* 5, 1726,7.

IV. *An Account of four Mock-Suns, ſeen at* Kenſington, March *1ſt* 1726-7. *By Mr.* George Whiſton.

ON Wedneſday, March 1ſt, 1726-7, walking in a Garden at *Kenſington*, about a quarter after Ten, I happen'd to obſerve the following Appearance, which being very rare with regard to the whole of it, ſeems to deſerve that ſome Account ſhould be given of it.

I at firſt took notice of the Halo about the Sun, V. M. (Fig. 2.) with its uſual Circumſtances, which are pretty frequent; the upper part of it was very luminous, having a confus'd mixture of the Rainbow-Colours in it, and being touch'd at the Vertex with the two other Curvatures, OVR, NVT, in the Situation which the Scheme ſhews; tho' the latter Arch NVT, did not appear till ſome time after. The Bottom part of it alſo at M, which appeard a little above the Horizon, had ſomething of the ſame nature, but not in ſo great a degree.

I preceiv'd, preſently likewiſe, the two *Parhelia*, A, B; whoſe Diameters were pretty large, and whoſe Brightneſs and Colour was pretty much as the upper part of the Halo.

As the Halo was at that time not quite perfect, but had ſome parts interrupted, I thought that the two *Parhelia* were in the Circumference of its Circle, as uſual; but after about a quarter of an hour, I directly obſerv'd the Halo to paſs between the *Parhelion* A, and the true Sun; and I have no reaſon to doubt the

ſame

ſame of the other B, alſo, tho' I don't remember that I directly obſerv'd that.

The *Parhelia* A, B, therefore, which were but a little diſtant from the Circumference of the Halo, began now to appear with narrow, pale, whitiſh Streaks of Light, in the nature of Tails, proceeding from them; but ſoon extended themſelves ſo far, that they met in the Point oppoſite to the Sun, and form'd the Great Circle, A B C D, parallel to the Horizon, whoſe Breadth was about half that of the Halo.

Upon viewing it carefully all round, I ſoon diſcover'd a third Mock-Sun, C, of a plain whitiſh Light, without any mixture of Colours, (which was alſo the Caſe of the whole great Circle,) and preſently alſo a fourth, D, both of them pretty exactly reſembling each other, (as the two firſt did themſelves likewiſe,) very much inferior to the *Parhelia* A, B, in Brightneſs, tho' not ſo much in magnitude; for I eſtimate their Diameters to have been to the two firſt *Parhelia*, as 4 to 5.

As I had no opportunity of meaſuring the ſeveral Angles, I have plac'd the Mock-Suns, C, D, in the Scheme, rather in Agreement with former Obſervations, than my own Gueſſes; for they appear'd to me to be at a greater diſtance from each other, and nearer reſpectively to the two firſt *Parhelia*, which Difference M. *Huygens* attributes to the different Altitude of the Sun.

The Arch, NVT, not being very viſible while the Great Circle was, and indeed not extending it ſelf at any time near ſo far as to the *Parhelia*, or the Circumference of the great Circle, I could not determine by a direct Obſervation, whether the *Parhelia* A, B, appear'd in the Interſection of that Circle produc'd, with the great Circle; but the Curvature appear'd to me ſo plainly different from that, its Center not being, I reckon,

I reckon, above M, that I cannot but believe the *Parhelia*, A, B, were neither in the Interſection of N V O, with the great Circle, A B C D, nor of the Halo with the ſame Circle, in one of which Circumſtances they have hitherto appear'd; but between thoſe two Points, and much nearer to the Circumference of the Halo.

I thought I ſaw plainly at one time likewiſe, a ſmall Portion of a Secondary Halo, if I may ſo call it, as in the Scheme at P. It ſeem'd evidently to be an Arch of a Circle concentrical with the Halo, and ting'd with the Rainbow-Colours, whoſe Diameters might perhaps be to that of the Halo, as 4 to 3; but as it appear'd but for a little time, I would not be thought poſitive about it.

I don't at all remember, that during the time I watch'd it, I ever obſerv'd the great Circle A B C D, to be viſible within the Halo, between A and B, tho' all the other part of it was ſometimes very perfect.

This Face of the Heavens continued, tho' with an Interruption of ſome parts now and then, till about a quarter after eleven, when I left it, and could not return till about twelve, at which time the Sky was clouded over, (which had been before only hazy, a ſure Criterion of theſe Appearances) and this Phænomenon no longer viſible.

V. *Cryſtallorum quarundam rariſſimarum nuper detectarum deſcriptio, ex literis Viri Cl.* Johannis Jacobi Scheuczer, *ad Dominum* Hans Sloane, *Bar. Reg. Soc. & Coll. Med. Lond. Præſidem.*

IN ſummis *Grimſulæ* jugis, paucis abhinc annis detecta eſt, nunc exhauſta, in ſaxo medio, cryſtallorum vena, quibus nec majores, nec puriores, vidit fortè orbis. Maxima earum pars, ad 60 circiter centenarios, in manibus eſt *D. Friſching* paſtoris *Haſleani*, venales omnes, ſed pretio, quod ex ſequentibus patebit, haud vulgari, quod fortè, præter puritatem, excuſat rara magnitudo. Præcipuarum en, quam nuper ab ipſo expetii poſſeſſore ſeriem!

Num 1. Duorum vel 2½ centenariorum, longa 2 ped. 9½ dig. Peripheria 3 ped. 7½ dig. limpidiſſima, hexagona. Pretium libræ 1½ Ludov. aur.

N. 2. Pondus 136 ℔, longit. 2 ped. 3 dig Peripheria 2 ped. 9 dig. Purpuras quaſdam habet ad marginem, puriſſima cæterùm. Pretium libræ 1 Ludov. aur.

N. 3. Pondus 135 ℔, longit. 2 ped. 4 dig. Peripheria 3 ped. 2 dig. limpidiſſima, excepto apice; pretium libræ 4 Floren.

N. 4. Pondus 96 ℔, longit. 2 ped. Peripheria 2 ped. 9 dig. pretium idem.

Ita deſcendendo pergit ad 10 librarum pondus, qualitatis, proportionis, pretii varii.

VI. *An*

VI. *An Account of a Stone taken out of a Horſe, at* Boſton *in* New England, *in the Year* 1724. *By the Honourable* Paul Dudley, *Eſq*; *F. R. S.*

THE Owner of the Horſe never perceived that he ail'd any thing, till within a few Days before he dyed, and then ſuſpected that he might be troubled with the Gravel or Stone, by the great Pain the Horſe ſeem'd to be in, when he ſtaled or dung'd; for he would groan and ſweat prodigiouſly. Upon which he got a Farrier, who applied ſomething to break the Stone; but in a very ſhort time the Horſe dyed: and the Farrier, being ſomewhat curious, was reſolv'd to open him, and in the great Paunch, found a Stone of five Pounds and an half Weight, almoſt as round as a Globe; for it meaſured ſeventeen Inches round one way, and ſeventeen Inches and three quarters the other. The Grit was like your *New Caſtle* Grindſtone; but was worn ſmooth in the Horſe's Stomach, the Colour ſomewhat like that of a Nutmeg. but more of the ordinary Millſtone. I could not perſwade the Owner to break it; but by the lightneſs of it, conſidering its Bulk, I am apt to think it might be porous within. How long this Stone was generating or what produced it, is altogether uncertain. The Owner of it was a common Carter to a Griſl-Mill; and ſome have thought that the Horſe might either in his Provender out of the Mill or by licking of Mill-Stones that ſometimes ſtand up by the ſide of the Mill get the firſt Seed of this Stone into his Stomach. The Weight of the Stone at length made a Fracture in the Paunch,

which proved his Death : For before the Breach, and while the Stone roll'd in his Stomach, he was very well.

The largeſt Stone found in any Animal that the *Philoſophical Tranſactions* give an account of, weighed but four Pounds, four Ounces.

VII. *An Account of a* Polypus *cough'd up from the Windpipe ; in a Letter from the Ingenious Dr.* Samber, *Phyſician at* Salisbury, *to Dr.* Jurin, *Secr. R. S.*

THE 15th of laſt *December* at 10 at Night, I was ſent for to one Mr. *Tompſon*, an Officer of the Exciſe in this Town, who was taken with ſo violent a Flux of Blood, that in a ſhort ſpace of time he loſt near three pounds of Blood, as near as we could judge : By the time I came, it was pretty well over ; only he ſeem'd to have ſomething, when he cough'd, that ſtuck in the Paſſage, which he could not get up, and by its rattling I thought it very looſe. I order'd what I thought proper in ſuch a caſe, and left him : Next Morning they told me, that half an hour after I was gone, he had cough'd up what they ſhew'd me on a Sheet of Paper, which Mr *Gifford* the Apothecary (a very honeſt Man, and very ingenious in his Buſineſs) had deſir'd them to keep till I came. Upon putting it into Water, I found it a *Polypus* ; and, as I think, a very remarkable one. I here ſend you a draught of it *Fig.* 3. exactly done by a Painter ſince dead. I could find by my Blow-pipe, that it was hollow ; but its being torn off with ſuch violence, has made ſo many

many Holes in it, that it cannot be blown up. You will (I believe) conclude, it lin'd the *Bronchia*, and that the Air had a Paſſage through it, and that a violent Fit of coughing had ſeparated the Adhæſion, and brought on that violent Flux of Blood, *&c.* He had been tormented with a Cough for more than ſix Months, was a gouty Man; but after this was cough'd up, and ſo large an Ulcer made, he had all the ſucceſſive Symptoms of a fatal Conſumption; as Cough, Spitting, Hectick, colliquative Sweats, Diarrhæa, and the *16th* of this Month died, Aged near 50.

Sarum, Jan. 28, 1726-7.

VIII. *An Account of a Book entitul'd* Vegetable Staticks: *Or an Account of ſome* Statical Experiments *on the* Sap *in* Vegetables; *being an* Eſſay *towards a* natural Hiſtory of Vegetation. *Alſo, a Specimen of an* Attempt *to Analyſe the* Air, *by a great Variety of* Chymico-Statical Experiments; *which were read at ſeveral Meetings before the* Royal Society, *&c. By* Stephen Hales, *B.D.F.R.S. Rector of* Farringdon, Hampſhire, *and Miniſter of* Teddington, Middleſex. *The Account by the Rev.* John Theoph. Deſaguliers, L L. D. *R. S. S.*

AS the Antients us'd to ſay, that Geometry and Arithmetick are the Wings of a Mathematician; ſo a Mechanical Hand, and a Mathematical Head are the neceſſary Qualifications of an Experimental Philoſopher. The firſt alone may enable a Man to make a great many Experiments, but not to judge of them: For without being able to obſerve, compare, and calculate the exact Quantity of Weight, Force, Velocity, Motion, or any other Change to be taken notice of in making Experiments; Effects may be attributed to Cauſes which are not adequate to them, and ſometimes expected to be produc'd even without a Cauſe; as appears by the Coſt and Trouble of thoſe who have attempted to find

find the Perpetual Motion. Tho' ſuch Perſons may make ſome Diſcoveries, their Philoſophy will be at beſt but conjectural, and their Concluſions only gueſs-work. The mere Mathematician on the other hand, wants *Poſtulata* in Phyſics; or taking things for granted upon the Reports of others, comes often to wrong Concluſions, tho' he reaſons juſtly; becauſe his Premiſes are falſe: Whereas he might have been ſet right in ſeveral caſes, by only obſerving the Operations of Handycraft-Workmen, which he had over look'd or deſpis'd. Men of warm Imaginations, who wanted Mechanicks or Mathematicks, or wou'd not apply them to Phyſicks, have peſter'd the Learned World with Philoſophical Romances, ſuch as the Carteſian Syſtem, contriv'd for the Diverſion of the lazy and talkative; or Modern Theories, which their Authors, blinded by Vanity, and urg'd by Obſtinacy, have defended to the laſt, againſt Reaſon, Mathematicks and Experiments; nay, and have often for the Support of their Hypotheſes, contriv'd complex Experiments, from whoſe Inaccuracy they have drawn Arguments to deceive themſelves and others, as much to the diſadvantage of true Philoſophy, as the Scholaſtick Diſputes of the *Ariſtotelians*; in which, Victory, not Truth, was contended for.

But the incomparable Sir *Iſaac Newton* has not only ſhorten'd the Geometrician's Work, by his wonderful Diſcoveries in abſtract Mathematicks; but has alſo taught us, by his own Practice, how to make, and judge of, Experiments and Obſervations with the utmoſt Accuracy: And as he avoided making Hypotheſes; he was ſo cautious as to deliver only by way of Queries, ſeveral Truths which he was convinc'd of; becauſe he wanted a ſufficient Number of Experiments to make them as evident as thoſe others, whereby he has ſo far

far improv'd and advanc'd Natural Knowledge. Our Author has follow'd his ſteps, aſſerting nothing but what is evidently deduc'd from thoſe Experiments, which he has carefully made, and faithfully related; giving an exact Account of the Weights, Meaſures, Powers and Velocities, and other Circumſtances of the Things he obſerv'd; with ſo plain a Deſcription of his *Apparatus*, and manner of making every Experiment and Obſervation, that as his Conſequences are juſtly and eaſily drawn, ſo his Premiſes or Facts may be judg'd of by any Body that will be at the Pains to make the Experiments, which are moſt of them very eaſy and ſimple.

His Account of every Thing is written in ſuch an intelligible manner, that the inquiſitive Reader is capable of underſtanding it, without being puzzled with perplex'd Calculations and complex Experiments; which Authors have ſometimes contriv'd, in order to be admir'd for thoſe Things, which they themſelves found out either by mere chance, or with very little Labour. He has illuſtrated, and put paſt all Doubt, ſeveral Truths mention'd in Sir *Iſaac Newton's* Queries; which tho' believ'd by ſome of our Eminent Philoſophers, were call'd in queſtion by others of an inferiour Claſs, who were not acquainted with thoſe Facts and Experiments upon which Sir *Iſaac Newton* bad built thoſe Queries.

But not to detain my Reader too long in general Remarks, I proceed to give a ſhort Account of each Chapter of our ingenious and indefatigable Philoſopher's Book.

CHAP.

CHAP. I.

Experiments, ſhewing the Quantity of Moiſture imbib'd and perſpir'd by Plants and Trees.

OUR Author having cover'd with mill'd Lead a Garden-Pot, in which a Sun-flower was growing, ſo as to leave only one Paſſage for Air to communicate with the Earth, and another to pour in Water to water the Plant, made ſeveral curious Experiments upon it; from the Obſervation of which it appear'd,

1. That the Plant, which weigh'd about 3 ℔, perſpir'd 30 Ounces in a 12 Hours Day, in the Month of *July*, 1724. But in a warm Night it perſpir'd only three Ounces, and nothing in a cold Night; nay, ſometimes it gain'd Weight by imbibing Dew.

2. That as the Area of the Surface of the Leaves was equal to 5616 ſquare Inches, and the Area of the Roots only to 2286 ſquare Inches; the Moiſture or Water imbib'd by the Roots to ſupply the Perſpiration at the Leaves muſt move faſter in the Roots than thro' Leaves, in the Proportion of 5 to 2; but in the Stem, whoſe tranſverſe Section was one ſquare Inch, faſter than in the Leaves, in the Proportion of 5616 to 1.

3. That by comparing his Experiments made on this and other Sun-flowers and Plants, with Dr. *Keil's* Experiments mention'd in the *Medicina Statica Britannica*, it is evident, that a Man (Surface for Surface) perſpires more than a Plant, in the Proportion of 3 ½ to 1 — That the Quantity of the Food of a Man is to the Food of a Plant nearly as 7 to 2; but, Bulk for Bulk, the Plant imbibes into its Veſſels 17 times

times more Fluid than the Quantity of the Chyle which enters into a Man's Veſſels; and that becauſe, as the Sap to Plants is leſs nutritive than Chyle to Man, it muſt be more in Quantity. To ſuck in the more Sap, a Plant has a very great Surface, and thereby (Perſpiration promoting its imbibing of the Sap) perſpires 17 times more than a Man in proportion to their reſpective Weights.

4. That a Man or a Plant may perſpire different Quantities, and yet continue in a healthy ſtate. A Man may perſpire in 24 Hours from 1½ ℔ to 3 ℔; and a Plant, which at one time perſpir'd but 16 Ounces, may without being leſs healthy, perſpire 28 Ounces in the ſame time.

Mr. *Hales* obſerv'd, that in order to ſupply the Evaporation in the Leaves of a Vine, the Sap roſe 152 Inches in 12 Hours, ſuppoſing the Sap to riſe as denſe as Water; but if it riſes in a Steam, which muſt at leaſt be 10 times rarer than Water, then the Velocity of the Sap will be 10 times greater, and conſequently riſe at the rate of 125 Inches in an Hour.

N.B. *That the Heat of the Sun ſhould rarifie the Moiſture of the Earth to that Degree, or a great deal more, to drive it into the Roots of Plants, is very probable from ſome Obſervations that Mr.* H. Beighton F.R.S. *and my ſelf have made upon the Engine to raiſe Water by Fire; whereby it appears that the Steam or Vapour of boyling Water is rarer than the Water from which it was produc'd, above* 13000 *times, when its Elaſticity is equal to that of common Air.*

Our Curious Experimenter, by his Obſervations upon 12 Evergreens, found, that they perſpire much leſs than other Plants, and compares them to the exanguious Tribe of Animals; which, as they perſpire little,

little, ſo they live the whole Winter without Food. He likewiſe obſerv'd, what part of an Inch in Thickneſs is perſpir'd by a Man and by ſeveral Plants: By a Man in 24 Hours $\frac{1}{50}$ part of an Inch; and by the following Plants, *viz.* the Vine, the Sun-flower, the Cabbage, the Apple-Tree, the Lemon-Tree, $\frac{1}{191}$, $\frac{1}{165}$, $\frac{1}{86}$, $\frac{1}{104}$, $\frac{1}{242}$, part of an Inch in 12 Hours.

That when the perſpiring Surface is diminiſh'd by taking away the Leaves, the power of imbibing is likewiſe diminiſh'd; for the ſame Bough, which with the Leaves on imbib'd 30 Ounces in 12 Hours, without the Leaves imbib'd only 1 Ounce.

That Fruit will imbibe thro' the Stem in proportion to its Surface, tried in an Apple, which imbib'd as much as two Leaves equal to it in Surface.

That as the Leaves draw Nouriſhment to the Bloſſoms and Fruit, ſo they grow large firſt in thoſe Places where the Bloſſoms are.

That Hops in the middle of an Hop-Ground thrive beſt, becauſe they imbibe and perſpire the leaſt.

That by 9000 Hop-Vines growing on one Acre of Ground, 220 Gallons of Water are imbib'd in a 12 Hours Day, which Quantity of Water is equal to a Depth of $\frac{1}{101}$ part of an Inch ſpread on the ſaid Surface.

That Fire-Blaſts (as the Gardiners call them) may be occaſion'd by Solar Rays reflected from, or condens'd by Clouds, or even collected by means of the denſe Steams, which ariſe moſt plentifully in the middle of the Hop-Ground.

That the perſpiring Matter of Trees is not protruded by the Power of the Veſſels, but exhal'd by Heat, which he proves by ſeveral curious Experiments.

He made Trees imbibe Spirit of Wine, and other Liquors impregnated with Aromaticks, which gave a Smell and Taſte to the Stalk, Leaves and Wood; but could not penetrate to the Fruit, by reaſon of the Fineneſs of the Capillary Sap-Veſſels near the Fruit, which aſſimilated to their own Subſtance the high-taſted and perfum'd Liquors. Spirits kill'd the Trees, as far as they were imbib'd; but ſcented Waters did not.

He receiv'd in proper Veſſels the Matter perſpir'd from Trees which is a taſteleſs Water; but corrupts and ſtinks ſooner than common Water.

He weigh'd three Cubick Feet of the ſame ſort of (Brick-) Earth, taken from the Surface of the Earth downwards, in *July* 1724, the lighteſt of which was about twice the ſpecifick Gravity of Water: Then ſetting them to dry, found by the loſs of Weight, how much Water they contain'd; the greateſt Quantity exhal'd from a Cubick Foot being 10 ℔, and the leaſt, 6 ℔, 11 Ounces. N.B. *The Weights he made uſe of were Avoirdupoids.*

In order to find the Heat of the external Air in Green-Houſes and in Stoves, as alſo the Degrees of Heat at ſeveral Depths in the Earth, and in hot Beds, he provided ſix Thermometers, whoſe Stems were of different lengths, but adjuſted in their mark'd Degrees; ſo that they began at the freezing Point, and ended at 90 Degrees, where the Heat was equal to the Heat of warm Water, that may be born by the Hand, without ſtirring it about, which is the middle Point between freezing, and the Heat of boiling Water.

By theſe Thermometers he obſerv'd the Degrees of Heat in ſeveral Caſes to be as follows: *Of the Blood* =64. *Of the Human Body* =54. *Milk from the Cow, and Heat fit to hatch Eggs* = 55. *Urine* = 58. *Temperate*

perate Air = 18. *Greateſt Heat of Sunſhine in the Year* 1724 = 74. *And now this Year* 1727, *it is at* 76. *The common Heat of the Noon-Sun in* July = 50. *Air in the Shade at the ſame time* = 38. *The Heat in* May *or* June, *the fitteſt for Plants*, = *from* 17 *to* 30 *Deg. Autumnal Heat* = *from* 10 *to* 20. *A hot Bed, too hot for Plants, and about the Heat of Blood in Fevers* = 75. *Due Heat of a hot Bed* = 56. *Heat under a Glaſs at the ſame time* = 34; *and in the open Air* = 17.

Thermometers of this kind are now made by JOHN FOWLER in *Swithin's Alley* near the *Royal Exchange*, which have the Names of the following Plants, oppoſite to their reſpective moſt kindly Degrees of Heat, *viz. Melon-Thiſtle* = 31, *Ananas* = 29, *Piemento* = 26, *Euphorbium* = 24, *Cereus* = 21 $\frac{1}{2}$, *Aloes* = 19, *Indian Fig* = 16 $\frac{1}{2}$, *Ficoides* = 14, *Oranges* = 12, *Myrtles* = 9.

He obſerv'd the Air to be cooler than the Earth out of the Sun, but hotter in Sunſhine; and that as ſoon as the Heat of the Sun is ſo far decreas'd, as no longer to give a brisk Agitation to (or turn into Steam) the Moiſture of the Earth, the Leaves of the Plants fall off.

CHAP. II.

Experiments whereby to find the Force with which Trees imbibe Moiſture.

OUR Author, in order to make a juſt Eſtimate of the Force with which the Moiſture is drawn up by Plants and Trees, contriv'd an *Aqueo-mercurial* Gage in the following manner. He took a Glaſs-Tube of an Inch Diameter, and about 8 Inches long, into one End of which he cemented a ſmaller Tube of about $\frac{1}{4}$ of an Inch Diameter, and 18 Inches long; into the other End he, ſucceſſively, cemented a Root, or Branch, or Stem of a Tree or Plant, whoſe imbibing Force he wanted to find out, which he did in the following manner, *viz.* He turn'd the ſmall End of the Gage upwards; and having pour'd Water into it, down upon the Wood cemented in, he ſtopt the Orifice with his Finger; then turning the little End downward again, he plac'd it into a Veſſel of *Mercury*, before he took off his Finger; which having done, he made his Obſervations. For as the Plant imbib'd the Water, the *Mercury* roſe up in the ſmall Tube, following the Water, and ſhewing by its Height, the Force of imbibing: And for every Inch that the *Mercury* roſe, Water would have riſen 13 $\frac{2}{3}$ Inches, as it is ſo much lighter ſpecifically than Water.

With this Gage our Author made Experiments upon Roots, Branches in an erect, Branches in an inverted Situation, large ones, as well as ſmall, even to Sprigs of Plants and Fruits; and found, that all of them imbib'd the Water, ſo as to raiſe the *Mercury* in the ſmall Tube, but to different Heights. The *Mercury* was raiſed the quickeſt, and to the greateſt height (*viz.* 12 Inches,

Inches in 7 Minutes) by a Nonpareil-Branch two Foot high, with 20 Apples, and ſeveral lateral Branches, whoſe tranſverſe Section was $\frac{1}{5}$ of an Inch diameter. It is to be obſerv'd, that the *Mercury* roſe higheſt in a warm Sun; but the whole force of imbibing was much greater than the *Mercury* could ſhew; becauſe ſeveral Bubbles of Air came out of the Section of the Branch, as the Water went up, which happ'ned moſtly in large Branches, which raiſed the *Mercury* but to a ſmall height: But Branches ſtripp'd of their Leaves, hardly raiſed it all.

He made Peaſe imbibe Water, under the preſſure of great Weights; and found, that Peaſe, when ſwell'd, ſuſtained a Weight equal to 1600 ℔, by their force of imbibing, or growing.

The force of imbibing, he ſhews, to be owing to the attractive power of the Particles of which Plants are made up; all kinds of Wood (even Cork) when their Particles are well ſoak'd, being heavier than Water.

N.B. *It is very difficult to ſoak Cork ſo thoroughly as to make it heavier than Water: But I found it true, in a Tube where a Cork had been ſeal'd up with Water for four Years, ſo as to be moveable in the ſaid Water.*

CHAP.

CHAP. III.

Experiments, ſhewing the Force of the Riſe of the Sap in the Vine, in the Bleeding Seaſon.

MR. *Hales*, by a very curious Contrivance of Glaſs-Tubes, ſcrew'd and cemented at the top of one another, and altogether fixed to the Stem of a Vine, obſerv'd, that in the bleeding Seaſon (*viz.* in *March* and *April*) the Sap will riſe into the Tubes, by the force of the Roots and Stem, to very great heights, even above the Top of the Vine, as it did up to the Top of a Tube 25 Feet high (in two Hours) and ran out at the ſaid Tube, tho' 7 Feet above the Top of the Vine. But the Force was ſuch, that the Mercury, in a Gage (in other Experiments) was puſh'd up 32½ Inches high, which was equivalent to above 43 Feet of Water. This is a much greater Force than the Blood is impell'd with in Animals: Which laſt Force he tried in the Crural Artery of an Horſe, of a Dog, and of a Deer: For having tied them down alive upon their Backs, and fixed a Glaſs-Tube to the Crural Artery open'd, he found, that in the Horſe the Blood roſe above 8 Feet, in the Dog about 7 Feet, and in the Deer not quite 6: And theſe Heights are 5, 7, and 8 times leſs than the Height to which the Sap is raiſed by the Vine. The Sap riſes all Night, but moſt in the Morning of a warm Day; but in very hot Weather it ceaſes to riſe about Ten in the Morning, and then begins again to riſe about 3 or 4 in the Afternoon; and during the great Heat, Bubbles of Air drawn in by the Roots, come up the Tube from the Section of the Stem, the Sap in the Tube ſinking and riſing, as the Weather is cloudy or clear, like the Liquor in a Thermometer.

That

That the Force was not only in the Root, but in the Stem and Branches, appear'd by ſeveral Experiments, one of which was, that a Vine, at 44 Feet, 4 Inches in diſtance from the Root, puſh'd up Sap with the Force of a Column of 30 Feet, 11 Inches of Water.

By a nice Experiment he ſhews, that the Sap does not come indifferently thro' all the Interſtices of the Wood; but is confined to its proper Veſſels.

The Fibres, or Capillary Tubes, out of the bleeding Seaſon, cannot protrude the Sap beyond their Orifices in the Section of the Stem; but, aſſiſted by the Perſpiration of the Leaves, the Sap will riſe in that very Branch, which would imbibe Water, if it was cut off, and a Tube applied to it with Water, poured in; nay, it wou'd alſo imbibe Water at the ſmall End.

CHAP. IV.

Experiments, ſhewing the ready lateral Motion of the Sap, and conſequently the lateral Communication of the Sap-Veſſels: The free Paſſage of it from the ſmall Branches towards the Stem, as well as from the Stem to the Branches. With an Account of ſome Experiments relating to the Circulation, or Non-Circulation of the Sap.

THE Analogy that there is in many reſpects between Plants and Animals, has made ſeveral ingenious Men imagine, that the Sap muſt circulate in Plants, as the Blood does in Animals; and, fond of the Hypotheſis, they have contented themſelves with a few Experiments that ſeem to confirm the Notion: And inſtead of making a ſufficient Number of Experiments

riments and Obſervations, and comparing them impartially, they have ſupplied the reſt by Conjectures, and endeavour'd to ſupport their Hypotheſis by other new Suppoſitions. It is upon this account that they have ſuppoſed particular Veſſels (like Arteries) to carry up the Sap from the Roots to the Extremities or Leaves, and others (like Veins) to bring down the Sap back again to the Roots; imagining the former to be chiefly in the middle of the Wood, and the latter to come down between the Bark and the Wood: But they did not conſider, that a Plant is very differently nouriſhed from an Animal, and therefore requires a very different Mechaniſm and Structure for its Growth and Support.

Our Author has diſproved the above-mentioned Opinion, by ſeveral Experiments and Obſervations; the chief of which are the following.

1. Having cut a long Notch in a growing Branch, which had Leaves on, he obſerved, that the Notch was moiſt at the Bottom towards the Root, and not at the Top.

2. He made the ſame Experiment with another Branch ſet in Water, which imbib'd the Liquor at a tranſverſe Section below the Notch, and found the Notch as before.

3. He obſerv'd, that in the Spring the Sap riſes plentifully between the Bark and the Wood, and that chiefly in Vines; and that if a Ringlet of Bark be taken off all round in bleeding Trees, the Bleeding abates moſtly in the upper part of the bare place.

4. The Sap will move any way by the Attraction of the ſame Capillary Tubes, and Perſpiration of the Leaves; ſhewn by an Apple Tree-Branch, which drew up Moiſture plentifully at the ſmall End; by a Tree, which throve, tho' its Root was taken out of the Ground,

Ground, receiving its Nouriſhment only from two other Trees, to which it was inarch'd, and from which it was ſuſpended; as alſo by a Bough with two Branches cut off from a Tree, one Branch of which out of the Water preſerv'd its Verdure, and receiv'd its Nouriſhment from the other Branch immers'd in Water, whilſt another Bough of the ſame ſort without that help, immediately wither'd.

That there is a lateral Motion of the Sap thro' Veſſels, whereby the longitudinal Capillary Fibres communicate with one another, he prov'd chiefly by the following Experiment, *viz.* He cut four long Notches, one above another, (but looking towards the ſeveral Cardinal Points) in a pretty large Branch, whoſe Section ſome Inches below the ſaid Notches, was immers'd in Water; and found, that by the Attraction of the Fibres and Perſpiration of the Leaves, the Moiſture roſe plentifully, notwithſtanding that the Continuity of the greateſt part (if not of all) the longitudinal Fibres was deſtroy'd by thoſe deep Notches.

This lateral Motion may alſo be deduc'd, from obſerving, that Branches will grow out of Roots, and thrive very well; and that Elders, Sallows, Willows, Briars and Vines will grow, by putting either End of a Stem or Branch into the Ground.

He obſerves, that there is indeed, an alternate Receding and progreſſive Motion of the Sap, which recedes when cold Weather and Rain ſucceeds hot Sunſhine, the Trees then imbibing the Rains and Dews which fall upon the Leaves; but upon the return of the hot Weather, the Perſpiration is renew'd, and the Sap riſes again. This is ſufficient to account for Jeſſamine and the Paſſion-Tree receiving a gilded Tincture below the gilded inoculated Bud; which has been given as an Inſtance of the Circulation of the Sap: But the *Ilex*

grafted on the Engliſh Oak, as it keeps (whilſt the Oak ſheds) its Leaves in Winter, ſhews that the Sap does not circulate.

CHAP. V.

Experiments, whereby to prove, that a great Quantity of Air is inſpir'd by Plants.

OUR Sagacious Author makes it appear in this Chapter, that Plants imbibe a great deal of Air, not only that which comes up with the Sap from the Earth (the Earth containing Air both in an elaſtick and in a fix'd ſtate,) but alſo take it in thro' the old Eyes and Bark, eſpecially at Night, when the Plants are in an imbibing State.

The Experiments whereby he proves the ſaid Aſſertion, are chiefly theſe, viz.

1. An open, empty, Glaſs-Tube ſet upright, had an Apple-Branch cemented in its upper end, the other End ſet in a Veſſel of Water; upon which the Air went up into the Branch out of the Tube, as appear'd by the riſing of Water into the Tube.

2. A Cylinder of Birch of about ¼ Inch Diameter, with the Bark on, cemented in the middle, to the Top of an Air-Pump Receiver, ſo as to fill up the Hole at the Top of the ſaid Receiver, had its lower End immers'd in a Veſſel of Water under the Receiver, upon the Plate of the Air-Pump. Then in working the Pump, Air came out at the Bottom of the ſaid Cylinder, bubbling

(bubbling up thro' the Water in the Veſſel) whether erect or inverted, cemented cloſe on the Top-Section, or not, and whether the old Eyes in the Sides were cemented up, or left bare, the Bark it ſelf being pervious to Air; but then it took in leſs Air than when the old Eyes and upper Section were open.

3. When Water (pour'd into a Cylindrick Glaſs fix'd over the Receiver) cover'd that part of the Wood which was out of the Receiver, no Air came thro' the Bottom; and when the Water was taken away from covering the upper part of the Wood, the Air did not come in thro' the Bottom, till the Top of the Cylinder of Wood had its Bark well dried.

4. He obſerves with Dr. *Grew*, that the Mouths of the Air-Veſſels are very viſible in the Leaves of Pines, and in the Trunks of ſeveral Plants, with a Microſcope; and in ſome even without a Glaſs.

5. In making Experiments upon young Shoots, as their Veſſels are full of Sap, he did not find that the Air paſs'd into or thro' them; (the Air in them being probably become fix'd) but it came in freely at the Roots applied to the Air-Pump in the ſame manner as in the Piece of Birch.

CHAP. VI.

A Specimen of an Attempt to analyze the Air, by a great Variety of Chymio-Statical Experiments, which ſhew, in how great a proportion Air is wrought into the Compoſition of Animal, Vegetable, and Mineral Subſtances; and withal how readily it reſumes its former elaſtick State, when in the Diſſolution of thoſe Subſtances it is diſingaged from them.

THE excellent Mr. *Boyle*, among his many Diſcoveries, found, that Air was producible from Vegetables, by putting Grapes, Plums, Gooſe-berries, Cherries, Peaſe, and ſeveral other ſorts of Grain into exhauſted and unexhauſted Receivers, where they continued ſeveral Days, emitting great Quantities of Air. But Mr. *Boyle* did not ſhew the way to know exactly how much Air a certain Quantity of Vegetable Subſtance will produce.

The incomparable Sir *Iſaac Newton* (*Query* 31, of his *Opticks*) obſerves, that "true permanent Air "ariſes by Fermentation or Heat, from thoſe Bo- "dies which the Chymiſts call *fixed*, whoſe Par- "ticles adhere by a ſtrong Attraction, and are not "therefore ſeparated and rarified without Fermentati- "on. Thoſe Particles receding from one another "with the greateſt repulſive force, and being moſt "difficultly brought together, which upon Contact "were moſt ſtrongly united. And (*Query* 30.) Denſe "Bodies by Fermentation rarify into ſeveral ſorts of "Air, and this Air by Fermentation, and ſometimes "without it, returns into denſe Bodies.

Mr.

Mr. *Hales*, from the Conſideration of this, and ſome of his own Experiments, concluded, that there muſt be Air not only in an elaſtick, but in a fix'd State, in Vegetables and other Subſtances, and therefore that the Air-Pump wou'd not be ſufficient to get all the Air out of Bodies: For which reaſon he contriv'd ways of getting the Air out of ſeveral Subſtances by Fire (diſtilling them,) and by Fermentation, and made uſe of a very ingenious, but ſimple and certain Method, of meaſuring the Quantity of Air generated from(or abſorb'd by) the ſeveral kinds of Bodies upon which he made Experiments. The Deſcription of his Hydroſtatical Gages, and the Manner of making his Experiments, I cannot give better, or ſhorter, than in his own Words. (*See Page 157.*)

" In order to make an Eſtimate of the Quantity of " Air which aroſe from any Body by Diſtillation or " Fuſion, I firſt put the Matter which I intended to " diſtil, into a ſmall Retort *r* (*Figure* 4.) and then at " *a* cemented faſt to it the Glaſs-Veſſel *a b*, which was " very capacious at *b*, with a Hole in the bottom. I " bound a Bladder over the Cement, which was made " of Tobacco-pipe-Clay and Bean-flower, well mixed " with ſome Hair, tying over all four ſmall Sticks, " which ſerv'd as Splinters to ſtrengthen the Joynt; " ſometimes, inſtead of the Glaſs-Veſſel *a b*, I made " uſe of a large Bolt-head, which had a round Hole " cut, with a red-hot Iron-ring, at the bottom of it; " through which Hole was put one Leg of an inverted " Syphon, which reached up as far as *z*. Matters being " thus prepared, holding the Retort uppermoſt, I " immerſed the Bolt-head into a large Veſſel of Water, " to *a*, the top of the Bolt-head; as the Water ruſhed " in at the bottom of the Bolt-head, the Air was " driven out through the Syphon: When the Bolt-

head

" head was full of Water to *z*, then I closed the out-
" ward Orifice of the Syphon with the End of my
" Finger, and at the same time drew the other Leg
" of it out of the Bolt-head, by which means the
" Water continued up to *z*, and could not subside.
" Then I placed under the Bolt-head, while it was in
" the Water, the Vessel *xx*; which done, I lifted the
" Vessel *xx*, with the Bolt-head in it, out of the Water,
" and tyed a waxed-Thread at *z* to mark the height
" of the Water: And then approached the Retort
" gradually to the Fire, taking care to skreen the
" whole Bolt-head from the Heat of the Fire. The
" Descent of the Water in the Bolt-head shewed the
" Sums of the Expansion of the Air, and of the Matter
" which was distilling: The Expansion of the Air alone,
" when the lower part of the Retort was beginning to
" be red-hot, was at a Medium, nearly equal to the
" Capacity of the Retort, so that it then took up a
" double Space; and in a white and almost melting
" Heat, the Air took up a triple space or something
" more: For which reason the least Retorts are best
" for these Experiments. The Expansion of the distil-
" ling Bodies was sometimes very little, and some-
" times many times greater than that of the Air in
" the Retort, according to their different natures.

" When the Matter was sufficiently distilled, the
" Retort, *&c.* was gradually remov'd from the Fire,
" and when cool enough, was carried into another
" Room, where there was no Fire. When all was
" throughly cold, either the following Day, or some-
" times 3 or 4 Days after, I mark'd the Surface of
" the Water *y*, where it then stood; if the Surface
" of the Water was below *z*, then the empty Space
" between *y* and *z*, shewed how much Air was
" generated, or rais'd from a fix'd to an elastick
" State, by the Action of the Fire in Distillation: But

" if

" if *y* the Surface of the Water was above *z*, the ſpace
" between *z* and *y*, which was filled with Water, ſhew-
" ed the Quantity of Air which had been abſorbed in
" the Operation, *i. e.* was changed from a repelling
" elaſtick, to a fixed State, by the ſtrong Attraction
" of other Particles, which I therefore call *abſorbing*.
" When I would meaſure the Quantity of this new
" generated Air, I ſeparated the Bolt-head from the
" Retort; and putting a Cork into the ſmall End of
" the Bolt-head, I inverted it, and poured in Water
" to *z*. Then from another Veſſel (in which I had a
" known Quantity of Water by Weight) I poured
" in Water to *y*; ſo the Quantity of Water which was
" wanting, upon weighing this Veſſel again, was equal
" to the Bulk of the new generated Air. I choſe to
" meaſure the Quantities of Air, and the Matter from
" whence it aroſe, by one common Meaſure of cubick
" Inches, eſtimated from the ſpecifick Gravities of the
" ſeveral Subſtances, that thereby the Proportion of
" one to the other might the more readily be ſeen.
" I made uſe of the following means to meaſure the
" great Quantities of Air, which were either raiſed
" and generated, or abſorbed by the Fermentation
" ariſing from the Mixture of Variety of ſolid and
" fluid Subſtances, whereby I could eaſily eſtimate the
" ſurpriſing Effects of Fementation on the Air, *viz.*
" I put into the Bolt-head *b* (Fig. 5.) the Ingredients,
" and then run the long Neck of the Bolt-head into the
" deep cylindrical Glaſs *a y*, and inclined the in-
" verted Glaſs *a y*, and Bolt-head almoſt horizontally
" in a large Veſſel of Water, that the Water might
" run into the Glaſs *a y*; when it was almoſt up to
" *a*, the top of the Bolt head, I then immerſed the
" Bottom of the Bolt-head, and lower part *y* of the
" cylindrical Glaſs under Water; raiſing at the ſame
time

" time the End *a* uppermoſt. Then before I took " them out of the Water, I ſet the Bolt-head and " lower part of the cylindrical Glaſs *a y* into the ear- " then Veſſel *x x* full of Water, and having lifted all " out of the great Veſſel of Water, I marked the " Surface *z* of the Water in the Glaſs *a y*. If the In- " gredients in the Bolt-head, upon fermenting, gene- " rated Air, then the Water would fall from *z* to *y*, " and the empty ſpace *z y*, was equal to the Bulk of " theQuantity of Air generated: But if the Ingredients " upon fermentation, did abſorbe, or fix the active " Particles of Air, then the Surface of the Water " would aſcend from *z* to *n*, and the Space *z n*, which " was filled with Water, was equal to the Bulk of Air, " which was abſorbed by the Ingredients, or by the " Fume ariſing from them: When the Quantities of " Air, either generated or abſorbed, were very great, " then I made uſe of large chymical Receivers, inſtead " of the Glaſs *a y*: But if theſe Quantities were very " ſmall, then inſtead of the Bolt-head, I us'd a deep " cylindrical Glaſs, or a common Beer-Glaſs inverted, " and placed under it a Vial or Jelly-Glaſs, taking " care that the Water did not come at the Ingre- " dients in them: Which was eaſily prevented, by " drawing the Water up under the inverted Glaſs " to what height I pleaſed, by means of a *Syphon*. " I meaſured the Bulk of the Spaces *z y* or *z n*, by " pouring in a known Quantity of Water, as in " the foregoing Experiment, and making an allow- " ance for the Bulk of the Neck of the Bolt-head, " within the Space *z y*.

By our Author's Experiments made upon ſeveral Subſtances, it appear'd, that ſome by Diſtillation, and ſome by Fermentation, wou'd generate Air, others wou'd abſorb it; and ſome again, wou'd abſorb

Air

Air at one time, and generate it at another; and oftentimes that more Air was generated by Fermentation than by Fire. I have made a Table, to ſhew at one View what the Effects were.

Bodies which generated Air.	*Bodies which abſorb'd Air.*	*Bodies which ſometimes generated, and ſometimes abſorb'd Air.*
Hog's Blood.	Salt of Sal Armoniac.	Gun-Powder.
Tallow.	*Phoſphorus.*	Apples maſh'd.
Fallow-Deer's Horn.	Acid Spirits.	Filings of Steel and *Aqua fortis.*
Oyſter-ſhells.	Lime.	Scurvygraſs-Leaves
A Piece of Oak.	*Pulvis urens.*	*Sal Armoniac* mix'd with Oil of Vitriol.
Indian-Wheat.	Brimſtone-Matches burning.	Spirit of Turpentine mix'd with Oil of Vitriol.
Peaſe.	A burning Candle.	Vineger pour'd on Oyſter-ſhells.
Muſtard-Seed.	Living Animals. *e.g.* a Rat and a Cat.	Limon-Juice.
Amber.	Humane Lungs in breathing.	Ale.
Tobacco.	Filings of Iron with Sp. of Nitre.	Malaga-Raiſins.
Oil of Anniſeed.	Filings of Iron with Spt. of Hartſhhorn.	
Oil of Olives.	Filings of Iron with Spirit of Sal Armoniac.	N. B. *Moſt of the abovemention'd Subſtances were in an abſorbing State in cold Weather.*
Honey.	N. B. *When a lighted Candle is put into that Air which had been foul'd (by a Candle burning and going out in it) tho' it burn'd but a fifth part of the Time that it had done before, it abſorb'd as much Air; which ſhews that Air loaded with Vapours is more apt to loſe its Elaſticity, than clear Air.*	
New-caſtle-Coal.		
Wax.		
Earth.		
Salt.		
Antimony.		
Pyrites from *Walton*-Heath.		
Sea-Salt.		
Nitre.		
Calculus humanus.		
Vitriol.		
Bones.		
Red Lead.		
Chalk.		
Wheat and Barley.		
Filings of ♂ with Oil of Vitriol and Water.		

As ſeveral Perſons may be willing to try a great many of Mr *Hale's* Experiments, I thought proper to mention here, that the Experiments on Subſtances that generate Air, made with the Glaſs-Retort, are difficult and tedious; but a Musket-Barrel with the Touch-hole welded up, and then turn'd into a Semi-circle, makes a very commodious Iron-Retort, whoſe cloſe End being put into the Fire of a Smith's Forge, will be ſo heated with a little blowing, as to get the Air out of any Subſtance in a very little time; having firſt twiſted on upon the open End of the Barrel one End of a Leaden Syphon (which will be very tight, with only a little Sheep's Leather between) whilſt the other End of the Syphon goes up a little way into an inverted Chymical Receiver fill'd with Water. As the Air gets out of the Subſtances diſtill'd, it comes bubbling up thro' the Water, which it depreſſes by its Bulk. N.B. *Antimony and Sulphur muſt not be made uſe of in this Barrel; becauſe they will demetallize the Iron; nor Lead, becauſe it will ſweat out thro' the Iron.*

It appear'd by ſeveral Experiments, that the Air which was got out of the Subſtances above-mention'd, was true permanent Air; for it had, and, after many days, continu'd to have, both the Weight and Elaſticity of common Air, of which a cubick Inch weighs $\frac{1}{2}$ of a Grain, and after it had been compreſs'd, it wou'd expand again to its former Dimenſions.

Moſt of that Air had a poiſonous Quality, a Sparrow dying as it was put into the Air made of Oak, 11 days after the ſaid Air had been made. So Mr. *Boyle* found the Air drawn by the Air-Pump from Bread and ſome other Subſtances, to have a poiſonous Quality.

Air generated by *Indian* wheat and by Peaſe, and moſt other Subſtances, flaſh'd when the Candle was applied to it.

The

The moſt ſolid Parts of Animals or Vegetables commonly generated moſt Air: Of Vegetables, Oak and Peaſe generated the moſt Air; Oak $\frac{1}{5}$ of its Weight, and 216 times its Bulk, and the Peaſe more than $\frac{1}{3}$ of their Weight and 396 times their Bulk. But of all Subſtances, a Stone taken from the Bladder of a Man generated moſt Air, namely a Quantity of Air 645 times the Bulk, and above half the Weight of the Stone.

Our indefatigable Philoſopher, to judge the better of the reſult of theſe Experiments, contrived a Gage with a Tube ſeal'd at one end, and having the other (open End) immers'd in Mercury cover'd with Honey, which in the riſe of the Mercury in the Glaſs wou'd leave a mark to ſhew how far the Mercury had riſen, (See the Deſcription and Draught of it in his Book, *Page* 205;) by the force of compreſs'd Air, or of the Air that is generated from ſeveral Subſtances whilſt confin'd; and propoſes this Gage for meaſuring the Depth of the Sea, which muſt anſwer better than any Contrivance hitherto tried.

From obſerving that it wou'd require a Force 48 times greater than that of the Atmoſphere, to compreſs the Air that comes out of an Apple into the ſame ſpace again (which in an Apple of 16 ſquare Inches Surface, is equal to 11776 Pounds,) he concludes that the greateſt part of the ſaid Air muſt be in a fix'd State, and preſerv'd in that State by the Attraction of the Particles of Air and Apple in their Coheſion; otherwiſe Fruits and all other Subſtances that contain much Air, wou'd be torn to pieces by its repellent Force, with a greater Exploſion than that of Gunpowder; and therefore that the Air when extricated, does not conſiſt of fibrous Particles wound up like little Springs, but of Particles which do not touch

one another, but have a repellent Force, which is reciprocally proportionable to the Diſtances of the Particles: Agreeable to what Sir *Iſaac Newton* ſays in his Opticks, *Quer.* 31. " The Particles, when they " are ſhaken off from Bodies by Heat or Fermen- " tation, ſo ſoon as they are beyond the reach of " the Attraction of the Body, receding from it, " as alſo from one another, with great Strength, " and keeping at diſtance, ſo as ſometimes to take " up above a million of times more ſpace than they " did before in the form of a denſe Body; which " vaſt Contraction and Expanſion ſeems unintel- " ligible, by feigning the Particles of Air to be " ſpringy and ramous, or rolled up like Hoops, or " by any other means than by a repulſive Power.

Our Author made ſome Experiments upon a Calve's Lung's, which help to confirm Dr. *James Keil's* Aſſertion, *viz.* that the inner Surface of a Man's Lungs is equal to about 150 * ſquare Feet, which is about 10 times more than the Surface of the whole Body. Then by ſeveral Experiments and curious Obſervations, found, that of the Air which is inſpir'd by the Lungs in an Hour (*viz.* 48000 cubick Inches) about 353 Inches, or 100 Grains in Weight are deſtroy'd in that Time.

He ſhews, that the reaſon that Sulphureons Air is pernicious, is becauſe Sulphureous Air loſes its Elaſticity ſo faſt, that the Lungs will ſubſide in it, and the Blood conſequently ſtagnate. He concludes, that when the Particles of ſuch Air are united into pretty large *Moleculæ* in a fix'd State, they are too big to enter the Veſicles of the Lungs.

* *Since my making this Abſtract, Mr.* Hales *told me, that the inner Surface of the Lungs is double the Quantity here expreſs'd, which was ſo ſet down in his Book by miſtake.*

He

He ſhews the Miſtake of thoſe that ſuppos'd the Air did not loſe its Elaſticity, but its *Vivifying Spirit* by Vapours, by an Experiment made upon a Dog, into whoſe Lungs he drove by Force that effœte Air which the Dog by his own Action cou'd not draw into his Lungs; and whereas the Dog, then, was juſt expiring by the ſubſiding of his Lungs, he kept him alive by the forcible Impulſion of that very Air, as long as he cou'd blow up the Dog's Lungs with it.

He makes it appear, that a cloſe warm Air without a Communication with the outward Air, to carry off the Vapours, muſt be unfit for breathing long; and therefore condemns the uſe of *German* Stoves.

That when Animals are kill'd by Lightning without any viſible Wound, it is becauſe the Sulphureous, Steams have deſtroy'd the Elaſticity of the Air about them; as appears by diſſecting ſuch Animals, whoſe Lungs are always found compreſs'd together without any Air in them. The ſame alſo appears in Men that have been kill'd by Damps in Mines.

Then he gives the Deſcription of an Inſtrument whereby 4 or 5 Quarts of the ſame Air, (which in the common way can ſerve one Man to breathe very little above a Minute) may ſerve 8 ½ Minutes to breathe, by drawing in the Air which has been in the Lungs thro' 4 Diaphragms of Flannel dipp'd in a *Lixivium* of highly calcin'd Salt of Tartar, and afterwards dried, and blowing back the ſame Air in ſuch manner that it may at every Inſpiration return thro' the ſaid Diaphragms; which is done by means of two Valves. The Moiſture and Sulphureous Vapours of the Air are by this Contrivance ſtopp'd in paſſing thro' the Flannel, and thereby the Air continues wholeſome much longer than it

wou'd

wou'd in the common way of breathing: This he propoſes as uſeful to thoſe who have occaſion to go into Places where the Air is infectious; but where the noxious Vapours are not very denſe, Mufflers only of Cloth or Flannel impregrated with Salt of Tartar may ſerve, as he found by ſeveral Experiments.

He ſhews afterwards the Reaſons why *Pulvis fulminans* has more Force than Gun-Powder, and confirms Sir *Iſaac Newton*'s account of Fire and Flame (*Query* 9, and 10, of his *Opticks*;) but ſhews Dr. *Nieuwentyt*'s, Dr. *Boerhaave*'s and Monſ. *L'Emery*'s Account of Fire to be erroneous; but that it was not the matter of Fire, but Elaſtick Air which that laſt nam'd Gentleman had ſo often obſerv'd to be loſt in the Analyſis of Bodies.

That the artifical Sulphur made by Monſ. *Geofroy*, was inflammable chiefly on account of the Air ſupplied to it by the Oil of Tartar.

That if Fire was a peculiar Matter in Sulphur, it ought to dilate, not to condenſe, the Air; as it appears to do by Experiment. That Fire conſiſts in the Action and Reaction between repellent Air and attracting Sulphur; and that Heat is communicated by the Æthereal Medium mention'd by Sir *Iſaac Newton* in the laſt Edition of his *Opticks*.

That Fermentation will diſſolve Bodies without the Help of included Fire, acting according to its ſeveral Degrees; a lower Degree of it (ſuch as attends every inteſtine Motion) not being inconſiſtent with the healthy State of Plants and Animals.

That acid Particles by their great attractive Force diſſolve Bodies, ruſhing towards their Particles, ſo as to excite Heat, and ſhake aſunder ſome of them, and turn them into Air.

That

That Air, in a fix'd State, is the Bond of Union, which makes Salts durable, and which keeps together the Solid Parts of Vegetables, of Animals, and even Globules of the Blood.

That the Air in a moiſt State is ſooner abſorb'd by Sulphureous Steams, than in a dry State; for a Candle which in a dry Receiver burn'd 70″, burn'd but 64″ in the ſame Receiver when it was fill'd with the Fumes of hot Water; but yet abſorb'd one fifth part more of Air. But the abſorbing Subſtances loſe their Force of acting, when united in a large Body, Brimſtone in a Roll abſorbing no Air, tho' it does it ſo plentifully when reduc'd into Minute Particles.

That ſome of the Food of Animals generates, and ſome abſorbs Air, and the Digeſtion in a healthy State is beſt perform'd when there is but a little Air more generated than is abſorb'd.

From the Conſideration of the ſeveral Experiments made by our Author, in his Analyſis of Air, he makes it appear that our Atmoſphere is a Chaos of different Particles, ſome of which are elaſtick, and ſome unelaſtick; and that the elaſtick Parts are endued with very different Degrees ef Elaſticity, according as they are bigger or leſs, more or leſs ſolid, more or leſs watry; and therefore that ſome are eaſily and ſome more difficultly reducible to a fix'd State.

That it is chiefly by the Change of Air from a fix'd to an elaſtick, and from an elaſtick to a fix'd State, that this beautiful *Frame of Things* is maintain'd in a continual round of the Production and Diſſolution of animal and vegetable Bodies; and therefore, that there is as much reaſon to adopt Air among the Chymical Principles, as acid Sulphur; tho' it has hitherto been rejected by the Chymiſts.

This will be continu'd in the next.

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I. *A Catalogue of the Fifty Plants from* Chelsea-*Garden, presented to the* Royal Society, *by the Company of* Apothecaries, *for the Year* 1726; *pursuant to the Direction of Sir* Hans Sloane, *Bart.* Med. Reg. Præs. Col. R. Med. & Soc. Reg. *By Mr.* Isaac Rand, *Apothecary*, F.R.S.

201 A Butilon, *Dod.* 656.
202 — Americanum, fructu subrotundo pendulo, è capsulis vesicariis crispis conflato.
203 ++ Alkekengi Barbadense, patulum parvo flore; fructu amplo mucrone productiori.
204 — Indicum majus, *T. Inst.* 151.
205 — Curassavicum; foliis Origani incanis; flore vietè sulphureo, fundo purpureo, *Boerh. Ind. Alt.* II p. 66.
206 — Verticillato simile; foliis angustioribus, utrinque acuminatis.
207 — Virginianum perenne majus; flore luteo amplo; fructu minimo.
208 ++ Ammi perenne Moris, *Umb.* 22.
209 Apocynum scandens, Africanum; Convolvuli minoris folio & caule hirsutis, *Pluk. Phyt.* Tab. 137. f. 4.
210 Bidens Americana Apii folio, T. 462.
211 — Americana nodiflora foliis latis acuminatis.
Chrysanthemum Conyzoides, nodiflorum; semine rostrato bidente, *Sloan.* Hist. Vol. I. p. 62. Tab. 154. f. 4.

212 — Caroliniana ; florum radiis latiſſimis, inſigniter dentatis ; ſemine alato, per maturitatem convoluto.

213 # Bugloſſum Luſitanicum, bullatis foliis Moris, *Hort. Blæſ.*

214 # Caltha Africana, flore intus albo foris Violaceo, *T. Inſt.* 499.

215 Cardamine impatiens, vulgo Sium minus impatiens, *Gerard.*

216 — Impatiens altera hirſutior, *Raii Synopſ.*

217 # Clematitis peregrina foliis perinciſis, *C. B.* 300.

218 # Corchorus ſive Melochia, *J. B.* 2. 982.

219 # Coma aurea Africana fruticans, foliis Crithmi marini, *H. Amſ.* 2. 99.

220 # Kali ſpinoſum, foliis longioribus & anguſtioribus, *T. Inſt.* 247.

221 — — Foliis craſſioribus & brevioribus, *Ibid.*

222 # Lactuca Canadenſis, altiſſima, latifolia ; flore leucophæo, *T. Inſt.* 474.

223 Lathyrus ſylveſtris major flore minore ; foliis longius mucronatis.

224 Lavandula folio diſſecto, *C. B.* 216.

225 # Lychnis Hiſpanica major latifolia flore albo.

226 — Maritima repens, C. B. 205.

227 — — Anglica, amplioribus foliis.

228 — Orientalis Bupleuri folio, *T. Cor.* 24.

229 — — Calyce pyramidato, ſtriato, longiſſimo ; *T. Cor. ib.*

230 — — Foliis carnoſis ; caule ramoſiſſimo ; floſculis minutis onuſto.

Lychnis Orient. Saponariæ folio & facie, flore parvo & multiplici.

231 — Fruteſcens, Myrtifolia, Been albo ſimilis, C.B. 205.

232 — Segetum Meridionalium annua, hirſuta; floribus rubris, uno verſu diſpoſitis, *Boerh. Ind. Alt.* 214.

233 — Sylveſtris viſcoſa rubra anguſtifolia, C. B. 205.

234 — —, Viſcoſa, rubra altera, *Ib.*

235 — Umbellifera, montana, Helvetica, *Zanon.* 128.

236 ♯ Lyſimachia bifolia flore globoſo, C. B. 245.

237 ♯ Malvinda Ulmifolia, ſemine roſtrato.
Malva annua fruticoſa Fernambucana flore luteo, *Zanon* 132.

238 — — Semine bidente.
Malva Ulmifolia, ſemine cum gemino roſtro, *T. Inſt.* 96.

239 — Pimpinellæ majoris folio ſemine bidente.

240 — — — Folio anguſtiori ſemine bidente.

241 Malvinda, profundius ſerrato folio, ſemine tridente.

242 — Abutili folio, flore luteo ſpicato.
Althæa Indica Abutili ſubrotundo folio, flore luteo ſpicato, *Pluk. Phyt.* Tab. 74. f. 6.

243 — — —; flore luteo ſpicato minor.

244 ♯ Moldavica Betonicæ folio flore cæruleo, *T. Inſt.* 184.

245 — Orientalis, Betonicæ folio flore magno Violaceo, *T. Cor.* 11.

246 ♯ Myrrhis tuberoſa, nodoſa, coniophyllon Moris, *Umb.* 67.

247 Myrrhis folio Podagrariæ Rivin.

248 ♯ Niruri Barbadenſe, folio ovali ſubtus glauco, pediculis florum breviſſimis.

249 Senecio Virginianus, arboreſcens, Atriplicis folio, *Par. Bat.* 225.

250 Sherardia Teucrii folio flore purpureo, *Vaillant Diſc.* p. 49.

Verbena folio ſubrotundo, ſerrato; flore Cæruleo, *Sloan. Hiſt.* Vol. 1. p. 171. Tab. 107. f. 1.

II. *Some farther Remarks on* P. Souciet's *Diſſertations againſt Sir* Iſaac Newton's *Chronology, by* Edmund Halley, *L.L.D.* Aſtron. Reg. *In a Letter to Dr.* Jurin, *Coll. Med. & S.R.Soc.*

SIR,

WHEN I gave you my Paper of Remarks on *P. Souciet*'s Diſſertations againſt Sir *Iſaac Newton*'s Chronology, I was oblig'd to take what he was pleas'd to give us out of *Hipparchus*'s Comment on *Aratus*, not having then that Author himſelf by me. Since then, by the favour of a very good Friend, having gotten the *Florence* Edition of *Hipparchus*, *Anno* 1567, I find an Argument very much *ad Hominem*, which the R. P. muſt confeſs will bring the *Argonautick* Expedition full as low as Sir *Iſaac Newton* makes it.

P. Souciet in his fifth Diſſertation, Page 119, 120, finds out a Star of the firſt Magnitude, cloſe adjoyning to that we now call *the firſt Star of Aries*, as it is in the Catalogue of *Ptolemy*, where it is ſaid to be in the *Horn of Aries*, and not in the *Ear*. This Star the R. P. ſuppoſes long ſince to have diſappeared; but that being of old very conſiderable, it was from this firſt Star of *Aries*, the Zodiack began, tho'

tho' for Argument-ſake he is contented to let it begin as Sir *Iſaac* does, with the aforeſaid Star in the Ear or Horn; which *Hipparchus*, in the laſt and 54*th* Page, tells us, in his time follow'd the Equinoctial Colure the 20*th* part of an Hour: And ſuppoſing the Star that has diſappeared, to have been at that time preciſely on the Colure, it muſt differ but 45 Minutes of Right Aſcenſion therefrom: But how he comes to make the difference of Longitude 40 Minutes no way appears, and is *gratis dictum*.

In Page 49 of the ſaid *Florence*-Edition, *Hipparchus*, treating of the riſing and ſetting of the Conſtellations, tells us, that that of *Aries* began to riſe with 18 ½ Degrees of *Piſces* in the Ecliptic, and was wholly riſen with the 24*th* Degree of *Aries*, whilſt the Zodiack paſt the Meridian from 23 ½ Degrees of *Sagittary* to 14 Degrees of *Capricorn*: And again (Page 52) he ſays, that the Conſtellation of *Aries* began to ſet with the 29*th* Degree of *Piſces*, and was wholly ſet with the 26*th* Degree of *Aries*, whilſt the Zodiack paſt the Meridian from 29 Degrees of *Gemini* to 29 Degrees of *Cancer*. He tells us alſo that it was the very ſame Star that both roſe and ſet firſt in that Conſtellation, calling it ὁ ἐπὶ τῷ ἐμπροσθίῳ ποδός, Page 49: And again, Page 52 'tis named ὁ ἐν τοῖς ἐμπροσθίοις ποσίν, or *That in the Fore-feet* of the Ram.

This certainly is the Star P. *Souciet* would place on the Equinoctial Colure, and makes it long ſince to have diſappeared; without enquiring whether the aforeſaid *Data* were not abundantly ſufficient to determine its place in the Zodiack at that time; and without regard to the odd uncouth Poſture he muſt ſuppoſe the Conſtellation of *Aries* to be in, when he makes one or both of the Fore-feet ſo near to, and above the Horn or Ear.

Hip-

Hipparchus expreſsly ſays, that it roſe when 23 $\frac{1}{2}$ Degrees of *Sagittary* was on the Meridian, and ſet when 29 Degrees of *Gemini* paſt it; and taking the middle between thoſe Points, it is plain, that it culminated with about 26 Degrees of *Piſces*, and that it had North Declination; the Exceſs above 180 Degrees ſhewing that the Aſcenſional Difference was about 2 $\frac{3}{4}$ Degrees. But to give the Argument its full Scope, the Right Aſcenſion of 23 $\frac{1}{2}$ of *Sagittary* (allowing *Hipparchus* his Obliquity 23° 51′ 20″) will be found 262° 54′. And that of 29 Degrees of *Gemini* will be 88° 54′: So that this Star was above the Horizon (in the Latitude of 36 Degrees North; to which *Hipparchus* has adapted his Calculation) 12 Hours 24 Minutes or 186 Degrees; whence the Right Aſcenſion of the Star is juſtly concluded 355 Degrees 54 Minutes; and its Aſcenſional Difference preciſely 3 Degrees; which in that Latitude makes its Declination 4 Degrees 7 Minutes North. We have therefore gotten both the Right Aſcenſion and Declination of this ſuppoſed firſt Star of *Aries*.

Let us now ſee what Longitude and Latitude reſults from the aforeſaid Right Aſcenſion with 4 Degrees 7 Minutes North Declination, aſſuming the Obliquity with *Hipparchus*, to have been 23° 51′ 20″; and we ſhall by a juſt Computation, find the Star at that time to have been in 27° 53′ of *Piſces*, with 5° 24′ North Latitude, which therefore was reckoned the place of the Star at that time by *Hipparchus*. Add 2° 40′, for 265 Years between *Hipparchus* and *Ptolemy*, and we ſhall have its place, in *Ptolemy*'s Account, *Aries* 0° 33′, with 5° 24′ North Latitude. But the 22*d* Star of *Piſces* in *Ptolemy*'s Catalogue has the ſame Longitude and Latitude, with ſufficient exact-

actneſs, *viz.* *Aries* 0° 40′, with North Latitude 5° 20′, and is *Media trium in Lino Boreo Piſcium* (*Bayero.*) Hence it cannot be doubted but that this Star which *P. Souciet* takes to have been once a Star of the firſt Magnitude, was no other than the ſaid *22th* of *Piſces*, which in the *Britiſh* Catalogue, fitted to the Year 1690, is put down in *Aries* 22° 29′ $\frac{1}{3}$ with North Latitude 5° 21′.

How *Hipparchus* came to reckon this Star to be in the Fore-foot of *Aries*, does not at preſent appear; but it is not unlikely that theſe Commentaries of his upon *Aratus* were written ſome time before he ſet about making his Catalogue of the fixt Stars; when he might change his Opinion, and replace it in the *Line* of the *Fiſhes*, to which it ſeems more properly to belong.

Be that as it will, we will for once, ſuppoſe with *P. Souciet*, this Star to have been in the beginning of the Zodiack, or of the Conſtellation of *Aries*, and that at the time of the firſt fixing the Colures, that of the Vernal Equinox paſt 15 Degrees in Conſequence thereof. Now *anno ineunte* 1690, this Star being in *Aries* 22° 29′ $\frac{1}{3}$, if we add thereto 15 Degrees, we ſhall have *Taurus* 7° 29′ $\frac{1}{3}$ for the Point in the Ecliptic that was then the beginning of the Zodiack. Now 37 $\frac{1}{2}$ Degrees, at 50 Seconds *per Annum*, gives 2700 Years; from which deducting 1690, we ſhall have 1010 Years before *Chriſt.* But this Star having 5° 21′ North Latitude, the Colure, when it paſt over it, interſected the Ecliptick in 2° 20′ leſs Longitude, which gives the time 168 Years later, or but 842 Years before *Chriſt.* So that *malgrè cette* grande *decouvèrte*, the new Syſtem of Chronology is ſo far from being refuted, that it ſeems to be very much con-

confirmed thereby, at leaſt in the Opinion of the R. *Pere.*

I have aſſumed the Latitude to which *Hipparchus* might have adapted his Calculations, to be 36 Degrees; becauſe I find in Page 14. of the aforeſaid Edition that he makes the longeſt Tropical Day 14 h. 30′: And in Page 29, he tells us, that the Southern Star in the left Foot of *Bootes* (υ *Bayero*) having 27° 20′ North Declination, was above the Horizon, 14 h. 57′; whence it follows, that the Latitude muſt be 36° 5′. He alſo tells us, in the ſame Page 29, that this Star ſet when 22° of *Capricorn* culminated, and 6° of *Taurus* aſcended; repeating the ſame thing in Pag. 39, which leaves no room to ſuſpect that thoſe Numbers are not the ſame that *Hipparchus* had computed. I therefore thought it worth while to enquire in what Latitude 6 Degrees of *Taurus* riſes when 22 Degrees of *Capricorn* is on the Meridian; and with the Obliquity of the Ecliptick, as now we have it, the Latitude reſulting is 35° $\frac{1}{2}$ North; but with the Obliquity allowed by *Hipparchus*, it will be found leſs than 35°.

This I ſay, only to obviate any Objection that may be made by *P. Souciet* to the aforegoing Argument; tho' if he pleaſe to examine it, he will find that an Error of a Degree in the aſſumed Latitude, will by no means invalidate the Proof here given that this *Firſt Star of Aries* could be no other than the middle Star *in Lino Boreo Piſcium*, marked *n* by *Bayer.*

III. *An*

III. *An Account of the* Lumen Boreale, *as ſeen at ſeveral Times. By the Rev. Dr.* Langwith, *Rector of* Petworth *in* Suſſex, *Communicated in a Letter to the* Same.

SIR,

I AM very glad to find that the Accounts of the laſt *Meteor* are of ſo near an Agreement; for I perceive there is little difference but what may be owing to the time and place of Obſervation. We have had the ſame ſort of Lights here ſeveral times ſince my laſt; particularly,

Jan. 4. A Luminous Arch which extended it ſelf from N. E. to Weſt. The Streams all mov'd Weſtward. Wind N. W. *Merc.* 29 $\frac{1}{2}$.

Jan. 5. We had ſomething of the ſame Nature, but hardly enough for Obſervation; and yet, this very Night the Appearances were more remarkable in ſome parts of the Kingdom than thoſe of *October* the eighth. This I was inform'd of by a Perſon of Quality in *Lancaſhire*, who was pleas'd alſo to ſend me the enclos'd Deſcription and Draught, communicated to him by a curious Obſerver at *Liverpool*.

March 2*d*. Between 7 and 8, there was an Arch upon a black Baſis as before, extending it ſelf from N. E. to W. It's height variable, Pyramidal Streams of Greeniſh Light moving Weſtward. About a quarter paſt 8, there ſhot up from the Weſt a Stream of pale Flame-colour about 6 or 7 Degrees broad: It paſs'd over the *Pleiades*, and croſſing the *Meridian* a-

bout 19 Degrees to the North of our *Zenith*, deſcended as low as the Tail of *Urſa Major* which it left a little to the South. It continu'd thus for ſome Minutes and then gradually vaniſh'd. Wind North, *Merc.* about 30.

March 3*d.* The Appearances this Night were ſo extraordinary, that they wou'd require a long deſcription: But I ſhall chiefly take Notice of ſuch particulars as differ'd from thoſe of *October* 8.

1° That inſtead of one *Luminous Arch* in the North, here were *two* and ſometimes *three* one above another. They were diſtinct enough from each other in their upper parts, but blended together towards the *Horizon*, which they *generally* cut about *N. E.* and *N. W.* but ſometimes varied conſiderably from theſe Points.

The ſame Obſervation may be apply'd to the *heights*, for they were alſo variable; and in particular, the inner edge of the lowermoſt Arch was at ſometimes about 6 Degrees above the *Horizon*, at others, conſiderably more or leſs.

I ſuppoſe this extroardinary Appearance was owing to ſeveral diſtinct Collections of Luminous Vapours, which were either at different heights from the Earth, or different diſtances from the Eye.

2*dly*, Several of the more permanent Streams were bent, at times, into irregular Arches of different Curvatures and Poſitions.

Some of them held pretty near the ſame ſhape till they vaniſh'd, others went off moſt commonly in *Tangents* to ſome part of the former Curves.

3*dly*, The Flaſhing Streams from the *Eaſt* ſometimes met with thoſe from the *Weſt*, and ſo form'd continu'd Arches, of a pale colour, which quickly broke and vaniſh'd. No colouring follow'd upon the mixture of theſe Streams.

4*thly*,

4thly, The Streams of this kind mov'd moſtly *Southward*, but not to any certain Point; for they were inclin'd to the *Horizon* at all Degrees between 5, or leſs, and 90. There was ſometimes ſuch a ſtrange irregularity in their Motions as can hardly be deſcrib'd; for the Places from whence the Flaſhings were directed ſeem'd to vary every Moment.

As to the more ſteady *Pyramidal* Streams, they generally mov'd *Weſtward*; and tho' ſome of them, at times, ſeem'd to ſtand ſtill, or even move backward; yet I am apt to believe, this irregularity was only Apparent.

5thly, A little after the beginning of this *Meteor* there was a faint ruddineſs in the Sky towards *N. E.* and *N. W*; but when it was in its greateſt perfection, towards 12 o' Clock, I ſaw none of the *Priſmatick* Colours, tho' the Air was then full as light as I have ever known it upon theſe Occaſions. This helps to confirm me in the Opinion that the *Priſmatick* Colours in theſe Meteors were owing to the Sun.

Theſe Appearances began early in the Evening, and held, as I am inform'd, for a good part of the Night. Wind *N. Weſterly*, Merc. above 30.

I am told that theſe Meteors are much more common in the *North* of *England* than here, and that they go by the Name of *Streamers*, *Merry Dancers* or *Petty Dancers*. They alſo pretend to foretel the Weather by them, and ſay, that when the Streamers are green, they betoken Wet Stormy Weather; but when they are yellow, it will be Clear and Dry.

P. S. I don't know whether it is worth while to acquaint you, that *Ariſtotle* has given an *imperfect* Account of *ſome* of theſe *Meteors*.

I am, &c.

Petworth,
March 6, 1726-7.

B. Langwith.

IV. *The Deſcription of an* Aurora Borealis *mention'd in the foregoing Letter.*

My LORD,

ABout Seven 'o Clock at Night I was told that the Meteor call'd by our Sailors, *Merry Dancers*, was viſible, and very bright. Having ſeen ſeveral before, but had no opportunity of being particular in my Obſervation, I went out into the open Air, clear of Houſes, that I might have a better view all round the *Horizon*; from whoſe *Northern* part aroſe ſeveral Streams of Light, as if from behind a black Cloud. They were very many, and I believe, there was no poſſibility of numbering them, their Motion being ſo quick, ſhooting upwards to the *Zenith* with a Motion not be follow'd by the Eye. They had alſo another Motion which ſeemed to be ſide-ways, their higher Ends terminating ſometimes in a ſharp Point, ſometimes in two or three Points; they appeared from the *North-Weſt* to *North-Eaſt*; but were brighteſt in the *North*. Their Colour was pale like that of *Jupiter* through a Teleſcope, but not near ſo bright. Moſt of 'em reach'd the *Zenith*, where mixing with one another, they whisk'd round and form'd an Appearance like the *curling* Flame of a Glaſs-Houſe-Fire; they had a very irregular Motion, ſometimes turning inwards, ſometimes outwards, like the *Pendulum-Spring* of a Watch. This *circular* Light was the brighteſt, and ſeem'd to occupy near ten Degrees of the higheſt part of the Hemiſphere: Several Strokes of Light ſeem'd to dart from it to the *South*; but

but died before they got any conſiderable diſtance. In the *Weſt*, I ſaw two ſmall long Clouds, which interpoſed betwixt me and the light Streams; which I ſaw above the Clouds, and betwixt them, which convinc'd me that this Light (whatever it be) is far above them. I have drawn a Scheme of the whole Horizon, as it appear'd to me. *(See the Figure.)* That bright Star is *Jupiter*, whoſe Place then was 17° in *Aries*, and was about South-Weſt, I gueſs about 20° high. Some of the brighteſt Stars in *Taurus*, *Orion*, and *Aries* appear'd South and South Eaſt; but I have not placed thoſe but by gueſs. In this ſtate I left it: But was told by one that ſaw it after Ten o' Clock, that the whirling Light in the Zenith appeared of ſeveral Colours, as, blue, green, yellow, and reddiſh. But that I did not ſee.

I am, &c.

V. *A Letter from the Reverend Mr.* Edmund Barrel, *Rector of* Sutton *near* Dartford *in* Kent, *to Sir* Hans Sloane, *Baronet, concerning a Shock of an Earthquake felt in that Neighbourhood*, &c.

SIR, *Sutton, Aug.* 11*th*, 1727.

I had an Information brought to me Yeſterday, on purpoſe to be communicated to your Society; 'twas, that the Earthquake was felt very ſenſibly at a Farm on a Hill called *Skeat-Hill*, which is at the Weſt End of *Lullingſtone*-Park, belonging to *Percival Hart*, Eſq;

Esq; about 8 Miles South-West from *Dartford*: And the same Morning a Piece of Ground, in a Meadow in *Farningham*, about five Miles South of *Dartford*, fell in, so as leave a Pit about 8 or 10 Feet over and near as deep; and being on the same level with the River, it was (when seen that Morning) fill'd with Water, within 3 or 4 feet of the Top; tho' that Spot of Ground, was supposed to have been as sound as any about it, Carts having many times gone over that very place. I thought it not improper to trouble you with this, supposing, that the Curious, will be pleas'd to hear how far the Shock of the Earthquake was felt.

P. S. In my Letter about *Misselto*, I mentioned a visible Proof, that there always was a *germinating* Principle in the Seeds of this Plant, whenever the Berries remained on their Boughs till *May*. The Birds do not often permit any such to be found; but as I have formerly observed this, so I have met with some this Year, whereof I have herewith sent you a *Specimen*; wherein you will find both old ripe Berries and young green Ones, on the same Stalks; and in the old you may see (even through their Skin) the little *Germen* putting forth its Head from the Seed or Kernel. I have likewise formerly had a Suspicion that the Plants of *Misselto* are some *Male*, some *Female*: I am now further perswaded, that it may be so; and if this be confirmed by my future enquiries I will make bold to give you an Account of it.

I am, &c.

VI. *A Species of* ſubterraneous Fire, *obſerv'd in the* ſame County; *communicated in a Letter to* Dr. Jurin, *by* Robert Nesbitt, M.D. *Coll. Med. Lond. Lic.*

SIR,

I Here ſend, as you deſired, the beſt Account I can of a Species of *ſubterraneous Fire*, which was firſt taken notice of on the ſecond of *Auguſt* laſt, in a *Marſhy-Field* ſituated in the Pariſh of *Flinx-Hill*, about ten or twelve Miles South Weſt of *Canterbury* in the County of *Kent*.

This Fire began on the ſide of a little Brook near the Water, and continu'd to burn along its Bank, without ſpreading much for ſome Days. Afterwards it appeared on the other ſide, and extended it ſelf the ſpace of ſome Acres over the Field, conſuming all the Earth, where it burnt, into red Aſhes quite down to the Springs; which in moſt places lay four Feet or more deep. On the twenty fourth of *September* I went to ſee it, and found it had conſumed, as well as I cou'd gueſs by my Eye, about three Acres of Ground.

It then burnt in many Places, and ſent forth a great Smoak and ſtrong Smell, very like to that of a Brick-Kiln. It never flamed but when the Earth was turn'd and ſtirred. For ſome ſpace round where it was burning, the Ground felt hot, tho' the Graſs ſeemed no more parch'd than might reaſonably be expected from the Dryneſs and Heat of the Seaſon. I cauſed it to be turn'd up in ſeveral Places, and found the Earth hot

and

and wet near four Feet deep, and much hotter about two feet than near the Surface.

When this Earth was expoſed to the Air, tho' it was very moiſt and not hotter than you might eaſily bear with your Hand, the Heat increas'd ſo faſt, that in a few Minutes it was all over on Fire, like *Phoſphorus* made with *Allom* and *Flower.*

The Soil of the Field is of the ſame nature with that they make the *Turf* of in *Holland*; the Surface of it is always wet, except in extream dry Seaſons. This Year it was ſomewhat more parched and harder than uſual.

I believe, from what has been related, it is not more difficult to account for this Fire, than for thoſe Fires which often happen in *Hay-ricks* when Hay is ſtacked before it is thoroughly made.

P. S. I ſend you a Piece of the Earth, and ſome of the Aſhes. I ſhould have mentioned, that I took ſeveral Pieces of the Earth, before I was able to bring one away, becauſe of its firing; one Piece, in particular, I gave to my Servant, which firing in his Pocket, had almoſt burnt its way out before it was perceived.

I am, &c.

VII. *An Account of ſome Experiments on the Effects of the Poiſon of the* Rattle-Snake. *By Captain* Hall. *Communicated by Sir* Hans Sloane, Bar. Med. Reg *&c.*

IN *South Carolina* on the 10*th* of *May*, *Anno* 1720, having got a fine healthful Rattle-Snake about four feet long, I perſwaded three or four Gentlemen, and one Mr. *Kidwell* a Surgeon, to aſſiſt me in making ſome Experiments on the Effects of its Poiſon

We got three Curr-Dogs, the biggeſt not larger than a common Harrier, and the leaſt about the bigneſs of the largeſt ſiz'd Lap-Dog, all of them ſmooth haired.

The Snake being ty'd and pinn'd down to a Graſs-plat, we took the largeſt of them, which was a white one, and having tied a Chord round his Neck, ſo that it ſhould not ſtrangle him, another Perſon held one end while I held the other; the length was not more than four Yards each way from the Dog.

Immediately on our bringing the Dog over the Snake, the Snake raiſed himſelf near two feet, and bit the Dog as he was jumping; the Dog yelpt, by which I perceived he was bitten; and upon it I pull'd him to me, as faſt as I could, and perceived his Eyes fixt, his Tongue between his Teeth, which were cloſed, his Lips ſo drawn up as to leave his Teeth and Gums bare: In ſhort, he was quite Dead in a quarter of a Minute; but one Perſon (beſide my ſelf) was of Opinion it was in half that time: The firſt was the Opinion of the By-ſtanders, who were five or

 ſix;

ſix; but I believe, none of them ſo much uſed to meaſure time as the Gentleman and I were, from our conſtant making uſe of the half Minute, and quarter Minute Glaſs at Sea. We could not ſee where the Dog was bitten, nor any Blood: Upon which we ordered ſome hot Water to ſcald the Hair off; when we could find but one Puncture, which look'd of a bluiſh Green a little round it; it was juſt between his fore Leg, and his Breaſt; where (when the Legs are diſtended) the Hair is much thinner than in ſome other places.

Half an Hour after the firſt Bite we took a ſecond Dog, which was ſomewhat leſs, of a Liver-Colour, and in like manner brought him over the Snake, which in a very little time bit his Ear, ſo that we all ſaw it; he yelpt very much, and ſoon ſhew'd the ſigns of being very ſick, holding that Ear that was bit uppermoſt. He reel'd and ſtagger'd about for ſome time; then he fell down, and ſtruggl'd as if Convulſed, and for two or three times got up, each time wagging his Tail, tho' ſlowly, and attempting to follow a Negro-Boy, who uſed to make much of him. We put him into a Cloſet, and order'd the Boy to look after him.

About an Hour after the ſecond was bitten, we took the third Dog in like manner: The Snake bit him on the right ſide of the Belly, about two Inches behind the long Ribs; for we ſaw he had drawn Blood there. The Dog at firſt, I mean for about a Minute, ſeem'd not to be hurt; ſo we let him go, being one we could get again when we pleaſed. For that Day we put up the Snake, imagining his Poiſon was very near, if not quite expended.

In a little time after, which was juſt two Hours after the ſecond Dog was bit, the Boy told us he was dead.

About

About an Hour after I perſwaded Mr. *Kidwell* to open him, and I was in no ſmall haſte to examine the Heart, where I perſwaded my ſelf, I ſhould diſcover ſomething extraordinary; but could not perceive any remarkable Difference between that and many others I had ſeen, where there was no Poiſon in the Caſe. Mr. *Kidwell* laid open the Skull, and was of Opinion, that the Brain was more red and ſwoln than any he had ever ſeen; and he told me a little while after, that the Blood turn'd very black.

For that Day we heard no more of the third Dog which was bitten; but the next morning the Woman who own'd him came to me, complaining of my Cruelty for killing her Dog. She did not know when he died, but ſaid ſhe ſaw him at ſeven that Evening, which was about 3 hours after he was bit; and that he was ſo ſick he could ſcarce wagg his Tail. None of theſe Dogs were ſwoln before they died.

On the *Saturday* following, which was the 14*th*, we got two Dogs both as big as common Bull-Dogs. The firſt Dog, which he bit on the Inſide of his left Thigh, died in half a minute exactly, in the Opinion of two Gentlemen, who kept their Watches in their hands all the while: There were two very ſmall Punctures in his Thigh, which lookt livid, tho' no Blood was drawn. This Dog did not ſwell for four hours after he was dead. I ſaw him, and order'd him to be bury'd.

The ſecond Dog was bit about an Hour after the firſt, on the out ſide of his Thigh, where we perceived the Blood at two places: He ſoon ſicken'd, and died in four Minutes.

We thought his Poiſon was not ſpent; ſo we got a Cat (for we could get no more Dogs) which he bit about an hour after, though I can't ſay where. The Cat was very ſick, and we put her up in a Cloſet: By ſome means the Cat was let out in leſs than an Hour and a half after ſhe was bitten. The next Morning early ſhe was found dead in the Garden, and much ſwoln; ſo that no body cared to examine or ſearch where ſhe was bit.

About a quarter of an Hour after he had bitten the Cat, he bit a Hen twice: The Hen ſeem'd very ſick and drooping, and could not, or did not fly up to her uſual place of Rooſt among the reſt that Night; but the next Day ſhe ſeem'd very well, and continued ſo till Evening, when I order'd her to be Killed, and her Feathers ſcalded off: There were 2 Punctures in her Thigh, and a Scratch on her Breaſt over the Craw, all which lookt livid.

About a Week after, having got a large Bull-Frog, we brought that over him as uſual: He bit it with much force; ſo that he ſeem'd to faſten for a ſmall ſpace. The Frog died in two minutes or thereabouts. In leſs than a quarter of an Hour he bit a Chicken, which was hatcht the *Feburary* before, that died in 3 minutes; I can't ſay where it was bit, and I was at a loſs to try any further Experiments for a long time, for want of proper Subjects. Dogs and Cats were not to be had; for the good Women, whoſe Dogs had been killed, exclaimed ſo much, that I durſt not meddle with one afterwards.

About the Middle of *June* I took him out according to Cuſtom, and having got a common black Snake, not of the of Viper-kind, about two and a half or near three Feet long, in good Health, juſt

juſt taken; I put them both together, and irritated them both, that they bit each other, and I perceived the black Snake had drawn Blood of the Rattle-Snake before I took them aſunder.

In leſs than 8 Minutes the black Snake was dead, and I could not perceive the Rattle-Snake at all the worſe or ſick.

On the laſt Day of *June*, being *Friday*, I took him out to try, whether if he bit himſelf, it would not prove mortal to him. I hang'd him ſo, that he was not above half his Length on the Ground; and with two Needles at the End of a Stick, one to prick, the other to ſcratch, irritated him ſo much that he ſoon bit himſelf, after having attempted to bite the Stick many times. I then let him down, and he was quite dead in 8 minutes or thereabouts, but am ſure it did not exceed 12 Minutes.

A Gentleman perſwaded me to cut the Snake in five Pieces which he gave to a Hog, the Head-part firſt, in Sight of many of us. The Hog eat up all the Snake, and 10 or 12 Days afterwards I ſaw the ſame Hog alive and in Health.

This was no more than I had ſeen before; but doubted there might be a Miſtake, as that they had taken ſome other Snake for a Rattle-Snake: For being at the Houſe of *Charles Hart* Eſq; they ſhew'd me a Snake, which a Negro told me he had kill'd juſt before; it was in three pieces, the Head of it bruiſed into the Ground. While I was looking on, a Sow came and eat it up very greedily, tho' the Negro-man endeavour'd to hinder her, being afraid it would kill her; for ſhe had Pigs following her.

I never heard she was ſick for it, tho' I inquired; and about ten Days after I ſaw her in very good Health. I have heard fifty Relations of the ſame kind, and am told that thoſe Hogs which feed in the Marſhes will run after the common ſort of Water-Snakes, which are not poiſonous, and will feed on them greedily: And I aſſure you, in *Maryland* laſt *Auguſt* was two years I ſaw a Hog eat up the Head of a Rattle-Snake juſt cut off, and while it was gaſping very dreadfully; and I was told, it was a common thing, and it would do them no harm.

On the 10*th* of *June* 1723, Mr. *Thomas Cooper*, a Gentleman who practiſes Phyſick at *Charles Town*, and who was late of *Wadham-College Oxon*, a very Ingenious Man, ſent to me to let me know, he had got a fine Rattle-Snake which had been taken not above 4 Days, was about three feet and a half long, and that he deſign'd to try whether he could ſave ſome of the Dogs after the Snake ſhould bite them. He provided a large quantity of *Venice-Treacle* or *Mithridate*, I can't poſitively ſay whether, which he divided into two Potions, each about two Ounces; to one of them he put a large quantity of *Diaphoretic Antimony*.

The firſt Dog which the Snake bit on the Inſide of the Thigh, died ſo ſoon *(viz.)* in about half a minute, that we could not get the Potion, which was that *without* Antimony, down his Throat ſoon enough to expect it could have Effect.

Above an Hour after, the ſecond Dog was bitten by him, and had two Punctures or Holes in the fleſhy part of the Inſide of his fore left Leg, which did bleed more than any I had ſeen before: We immediately got down his Throat that Preparation *with Antimony*. He ſoon grew very ſick and ſtrove to vomit,

vomit; but I think brought up very little, if any; he froth'd at the Mouth and bit at the Graſs, which he champed, as if he were mad; and indeed we were all afraid of him. We therefore put him into a Room and there kept him till next Morning, where I ſaw him as I thought recover'd: We throw'd him ſome Meat, which he eat, ſo we let him out and he went home. About a Month after that, the Dog's Hair came off, and his Maſter killed him, being ſo ugly to look at; he told me, he lookt like a Leprous Perſon, (that was his very Expreſſion;) I never heard this Dog ſwell'd.

The third Dog which he bit was a Shaggy Spaniel, about an hour and a quarter after the ſecond. He was bitten on the foremoſt part of his right Shoulder, as we perceived by the Blood. The Dog ſeem'd to bite at the place himſelf, and was very ſick for that whole Evening (*viz.*) about 2 or 3 hours; but without any means or application he recover'd, and I never heard he was ſick afterwards.

VIII. *Quædam Notabilia in Cerebris trium* Epilepſiâ *mortuorum obſervata, quibus accedit Hiſtoria de* ſubſtantiâ Cataractæ. *Epiſtola Domini* Waltheri Curieuſi Rhæti, *ad Dominum* J. F. Woolhouſe, F. R. S. &c.

CUM hiccè, (ubi per unum alterumvè Menſem dego) *Venetiis*, cadaveribus ſufficientibus aperiendis nobis ſit occaſio, apud virum clariſſimum *Santorinum Pr. Anat*, erat Vir 35. *Annorum*, temperamenti & habitûs gracilis, abhinc duobus annis correptus dolore grava-

gravativo capitis in parte anteriore versûs frontem, & à D. Professoribus multa ac multa remedia accepit, sed frustra : transactis duobus annis Hæmorhagia narium Larga contigit, quæ tamen sponte item cessavit. Post Hæmorhagiam amisit sensum olfactorium. & posteà correptus fuit per duos annos *Paroxysmis Epilepticis* sæpiûs ingruentibus, denique mortuus est.

Secto cranio, vidimus Cerebrum in parte anteriore versùs *Duram Matrem* circà Regionem *Cristæ Galli*. in parte dextrâ durum & callosum. & arctissimè cum *Meninge durâ* connexum : in parte Cerebri anteriore versûs sinistram partem, inventa fuit extravasatæ materiæ sanguineæ aliqua quantitas, reliqua naturalia.

2. *Anasarcâ* laborans Mulier 60 annorum vehementissimis iisque sæpê repetitis acerbissimis *Insultibus* correpta obiit. Secto cranio, invenimus intrà *Piam Meningem* & Cerebrum, atque in anterioribus Cerebri ventriculis magnam satis extravasatæ lymphæ quantitatem, ut eâ ventriculi fermè turgidi fuerint. In *Plexibus Choroideis* conspectui sese tradidere plurima corpuscula albicantia, pellucida, serum aquosum in se continentia, variæ magnitudinis ; maxima ad magnitudinem seminis *Canabini* majoris accedebant, quæ à me, aliis dissentientibus, vesiculæ fuere nominata.

3. Dissecto Cranio Vetulæ alicujus quæ per multorum annorum tractum *Epilepsiæ* valdè obnoxia erat, vidimus intra *Piam Matrem* & Cerebrum, mediocrem Seri extravasati copiam, in anterioribus autem Cerebri ventriculis tanta talis Seri quantitas fuit, ut crepaturam illorum quasi minabatur. *Plexus Choroidæus* instar veri racemi apparebat uterque ; vesiculæ inibi plurimæ, rotundæ, pellucidæ, & variæ magnitudinis nobis visui sese obtulêre, & instar elegantissimarum apparebant Perlarum.

Hist.

Hiſt. Vetula circiter 50 annorum, dum viveret, ſiſtebat *Cataractam veram* in oculo ſiniſtro, Coloris *Perlacei*, magnitudine mediocris, ità tamen ut aliquantiſper pluſquàm dimidiam, eamque mediam *Pupillæ* partem occupabat, ſeu meliùs mediam & paulò pluſquàm dimidiam partem *Pupillæ*; colorem perlaceum habere repræſentabat, repræſentabat dico, nam vidi manifeſtè eam Cataractam retrò *Uveam*, & in 2dâ oculi Camerâ eſſe ſuſpicabar. Interrogatus à *Santorino*, in præſentiâ decem plùs minùs Medicorum, quid judicium meum ſit de hâc *Cataractâ*, an ſit *Cuticulæ* vel *Criſtallini* vitium? reſpondi, me potiùs pro *Cuticulâ* habere quam pro *Criſtallini* vitio, attamen id abſolutè & indubiè affirmare nolle, quoniam ſignum Pathognomonicum non datur. Reſpondenti mihi ridere cœpit, quod audeam aliquid de *Cuticulâ* ſive *membranulâ* ſtatuere, perſuaſus enim eſt ipſe, *Cl. Leiſteri Syſtema* certum eſſe *&c. Mortuâ diſſectâ*, hæc Vetula in oculo dicto ſiniſtro nobis de omnibus certiſſima obtulit: *Criſtallinus* enim *humor* erat pellucidus quibuſvis inſtitutis experimentis, nec ullâ maculâ aut minimâ obfuſcatione imbutus; erat equidem per totam ipſius molem ubique & æqualiter leviſſimè, leviſſimè inquam, citrino Colore perfuſus, vix namque aliquid hujus Citrini Coloris apparebat, in vivis adhuc dum exiſtente Vetulâ. *Cuticula* eadem Libera in nominatâ Camerâ exiſtebat, & non niſi duâbus ſubtiliſſimis fibrillis *Uveæ* adhærebat: Cætera erant naturalia, at *Pupilla* naturali quoque aliquantulùm major reperta; naturaliter ſivè à naturâ, & non præter-naturaliter. Hanc *Cataractam*, unà cum partibus vicinis omnibus, eo quo inveni ſitu monſtrare, & curioſorum oculos ſatiare poſſum; cujus ſectioni hâc *Die* 27 *Aprilis* hujus *Anni* 1727 factæ, reique ità repertæ Teſtes ſunt Cl. Dominus *Santorinus* & plures alii Medici & Chirurgi.

IX. *Two Chirurgical Queſtions, ſtated and anſwered by* John Douglas, *Surgeon, F. R. S.*

Q. I. WHether it is not poſſible in ſome Meaſure to relieve thoſe Perſons (who by reaſon of their great Age, bad Habit of Body, *&c.* cannot ſubmit to any of the great Operations for the Stone with tolerable hopes of Succeſs) by making an Artificial *Fiſtula* in the *Perinæum?*

A. That a great many Patients offer, both young and old, who are afflicted with the Stone in the Bladder, whom we cannot with any tolerable hopes of Succeſs, adviſe to ſubmit to the great Operations for the Stone, daily Experience ſhews. It is inhuman to cut them, and ſhews a very great Imperfection in our Art, to ſay we can give them no Relief. Is there no *Medium* yet found out between living in extream Miſery and ſubmitting to a deſperate Operation? Yes; *Thomas Fienús* about 125 Years ago, propoſed a Palliative Cure for ſuch Patients, where a radicative Cure could not be expected; an Operation which may be performed with ſafety on the moſt Ancient; the Wound is ſo ſmall, and the Parts cut of ſo little conſequence to Life. An Operation by which we can prevent or alleviate the moſt lamentable Effects of the Stone, *viz.* The total ſuppreſſion of Urine and the cutting Pains they endure in, and after making Water, *&c.* yet this Operation has been as little minded all this while by the *Hoſpital-*

Li-

Lithotomiſts, as *Roſſet*'s moſt excellent Treatiſe before I introduced the Hypogaſtrick Section in 1719. Tho' I admire *Fienús*'s deſign in making this *Fiſtula*, yet I can by no means approve of his way of doing it.

It ought to be performed thus: Place the Patient as in *Marianus*'s Operation; paſs a Staff into the Bladder, then cut the Skin and Fat until you lay that Part of the *Urethra* bare, which reaches from the *proſtate Gland* to the Cavernous *Urethra*; then make a ſmall Inciſion into it with the point of your Knife; then withdraw the Staff, and paſs a ſmall flexible *Canula* into the Wound of the *Urethra*; then dreſs the Wound S. A. extract the *Canula*, clean it and introduce it again every Dreſſing, that ſo you may leave a *Fiſtula* in the room of the Wound.

Through this *Fiſtula* the Patient himſelf or any one about him, may eaſily paſs an Oiled Probe, and puſh the Stone back whenever he finds himſelf attack'd with a ſuppreſſion of Urine, or when the Stone preſſes hard againſt the *Sphincter*, when endeavouring to make Water, which otherwiſe could not be done without the Ceremony of ſending for, and ſtaying in miſery till a Surgeon comes to paſs the *Catheter*, which in ſuch caſes is not always to be done, without a great deal of Pain, and ſometimes Danger. By this *Fiſtula* we can alſo very eaſily inject any Liquor that may be thought proper either to prevent or allay the Inflammation of the Bladder, or cleanſe it from the Gravel, or any other ſort of filth that may collect there, by which the increaſe of the Stone will be prevented, *&c.*

In Females all thoſe advantages are obtain'd by the natural ſtraitneſs and ſhortneſs of the *Urethra*, whence they never ſuffer the tenth part that Males do; which is an inconteſtable evidence that when the Paſſage into

the Bladders of Males is made as ſtreight and near as ſhort (as is done by the forementioned *Fiſtula*) they will reap the ſame advantages by it.

Therefore Artificial *Fiſtula*'s in the *Perinæum* ought to be made for thoſe who by reaſon of their great Age, and bad Habit of Body, *&c.* cannot undergo any of the great Operations for the Stone, with any hopes of Succeſs.

Q. 2. Whether it is not poſſible to dilate the artificial *Fiſtula* in the *Perinæum* of Males, and the *Urethra* of Females with Spunge or Gentian-Tents gradually increaſed for ſome time to ſuch a width, that we may eaſily paſs a pair of *Forceps* into the Bladder, with which the Stone when ſmall may be extracted, and when large, or of an irregular Figure, broke, and the pieces extracted gradually and at different times, when they cannot be extracted at once, without fatiguing the Patient too much?

A. To prove that both theſe *Fiſtula*'s may be dilated to a ſufficient bigneſs by the means propoſed, (eſpecially, if the parts are frequently bathed in a *Semicupium* or otherwiſe, as the Operator ſhall think proper, and ſome warm Oyl injected into the *Fiſtula* every time the Tent is changed, (the better to ſupple and relax the parts,) I ſhall only make uſe of three Arguments, *viz.* One from common Experience in Analogous Caſes; Another from the Operations of Nature on the ſame Parts; And the third from Inſtances of this Operation being perform'd after the Method I propoſe. 1*ſt*, Common Experience ſhews to what a great width Fiſtula's in all other parts of the Body, tho' very ſmall at firſt, may be dilated by Spunge or Gentian-Tents. 2*dly*, Nature herſelf with-

without any Art has frequently perform'd this Operation on both Sexes; in Males who have been cut for the Stone after the old way, and had *Fiſtula*'s remained in *Perinæo*. It is often found that ſome conſiderable time afterwards, Stones of no ſmall ſize have appeared which had made their way thro' the Sphincter of the Bladder into the Membranous *Urethra*, and ſtuck near the Orifice of the *Fiſtula*, whence they were eaſily and ſafely extracted. I ſaw a Stone lately as big as a Pullet's Egg that was expelled from the Bladder of a young Woman without any help, as her Phyſician aſſured me, and ſhe had no inconveniency afterwards, which certainly would have happen'd if it had been extracted after the common violent Method. In the laſt *Philoſophical Tranſaction*, Dr. *Beard* of *Worceſter* gives an Account of a yet larger Stone, that paſſed after the ſame manner, but ſhe had the common inconveniency afterwards, *viz.* an Incontinency of Urine, which was owing more to the roughneſs than the bigneſs of the Stone, which had lacerated the Parts as in the common Operation, which might have been prevented had ſhe been aſſiſted in time as above.

3*dly*. Monſ. *Collet* in his *Traité de la Taille*, gives an Account of a Gentleman on whom he perform'd this Operation three different times, and extracted in all ten Stones. His Words are as follow:

Enfin, Monſ. Uſſon *etant hors de danger & ſa playe prête a ſe cicatriſer, prévoyant bien ce qui pourroit arriver dans la Suite, je lui conſeillai de tenir ſa playe ouverte, pour y entretenir ſeulement une petite Canule, qui dans l'occaſion donneroit une entiere liberté de faire Injection pour nettoyer la Veſſie de toutes les Immondices & pour qu'on pût enlever les nouvelles Pierres qui pourroient ſe former. Il prit ce parti, & il ſe trouva bien durant cin-*

cinque Années, quil a Vecu depuis avec aſſez de Santé Mais a trois differents repriſes, je me ſuis vû Obligè de lui tirer juſqu'a dix autres pierres qui ſ'etoient formées dans laVeſſie : une petite Tente d'eponge preparée miſe pendant quelques heures dans la Fiſtule à la place de la Canule me facilitoit l'Entrée d'une tres petite tennette.' Monſ. Uſſon *s'habilloit dans ce Moment & il ſortoit pour aller par tout ou ſes Affaires l'appelloient.*

I know a Gentleman that now keeps a *Fiſtula in Perinæo* open for the very ſame reaſons.

Since then it is evident that *Fiſtula*'s in all parts of the Body are dilatable to a great width, ſince Nature is often able of her ſelf to dilate the very parts in diſpute, to a very extraordinary Degree; and ſince this very Operation I here propoſe has been ſucceſsfully performed three times on the ſame Perſon,

Therefore *Artificial Fiſtula*'s in Males and the *Urethra* of Females may be dilated ſo as to extract any Stone without cutting the Body of the Bladder, or lacerating any of the Parts.

N. B. This Operation will appear much leſs ſurprizing, if we conſider, that it is only dilating the Sphincter of the Bladder, *&c.* in a different manner from that daily done in *Marianus*'s Operation, *i. e.* By this Method the Parts are dilated gently and gradually, after being well bath'd and anointed, the better to relax them. Whereas in *Marianus*'s Operation they are dilated quickly and violently, and then the Stone, be it of what Largeneſs or Figure ſoever, is forcibly drawn out immediately; whence Contuſions, Lacerations, Hæmorrhages, Inflammations, Mortifications, *&c.*

X. *The Concluſion of Dr.* Deſagulier's *Account of* Mr. Hales's *Vegetable Staticks.*

CHAP. VII. *Of Vegetation.*

OUR Author in this Chapter applies his ſeveral Experiments, and Concluſions drawn from them, to Vegetation; and ſhews chiefly the following Things, *viz.* That Vegetables are compos'd of Sulphur, volatile Salt, Water, Earth and Air.

That in Nutrition the Sum of the attracting Powers of thoſe Subſtances is ſuperior to the Sum of the repellent; and as the watry Vehicle flies off, the Parts harden.

That Oil, which is made up of Sulphur and Air, abounds in Seeds for their better preſervation.

That in cold Countries, where thoſe Principles are not ſo firmly united, ſmall Wines, ſuch as *Rheniſh*, moſt eaſily yield their Tartar (which by Experiments appears to contain Oil and Air;) but generous Wines, ſuch as *Madera*, having thoſe Principles more firmly united, will bear a great degree of Heat before they part with them.

That the uſe of the Leaves of Trees is to bring up Nouriſhment within reach of the Attraction of the Fruit, to carry off the redundant watry Fluid; to imbibe Rains and Dews which are impregnated with Salt and Sulphur; as likewiſe to imbibe Air, and to be of the ſame uſe to Plants as the Lungs are to Animals.

That Plants which are overſhaded, or too replete with Moiſture, cannot ſo well imbibe Air: Therefore, tho' they will ſhoot out faſt, and have much Wood, they will be more barren in proportion.

Mr.

Mr. *Hales*, by a very ingenious Contrivance, found the Degrees of growing in every part of young Shoots, which in their growing extend themſelves moſt in the middle, and leaſt towards the top and the bottom; the ductile Matter for their growth being drawn out in length like melted Glaſs-Tubes, which retain a Hollowneſs, tho' drawn out to the ſmalleſt Thread. N.B. *In ſome Animals there is ſuch a tough ductile Subſtance, which hardens when expos'd to the Air in ſmall Threads, as in Spiders and Silk-Worms.*

He ſhews, that the Pith ſerves to ſupply the dilating Moiſture for the tender Shoots; but that their Figure may be oblong, and not round, as the Fruit commonly is, there are tough Diaphragms in the Pith at ſmall diſtance from each other, which check the lateral Expanſion; as alſo horizontal Fibres, which ſerve for the ſome purpoſe: And of the ſame ſort is the Pith in the large growing Feathers of Birds; which is made up of Veſicles that can be diſtended lengthwiſe, but have Sphincters at the ends, to prevent too large a lateral Dilatation. — That the Bones of Animals do not grow at the Joynts (which would prevent their free Motions) but at the *Symphyſis*, viz. where the Heads joyn to the Shanks of the Bones — That there are particular Veſſels in Vegetables, as well as Animas, appropriated for conveying different ſorts of Nutriment; and that where a viſcid Subſtance is to befurniſhed, the Veſſels are lengthen'd, and often fetch a compaſs to retard the Velocity of the Fluid, which is to be inſpiſſated into an hard Subſtance. Thus in hard Stone-Fruits the Umbilical Veſſel goes round theConcave of the Stone, and then enters the Kernel near its Cone.

Then at laſt, our Author traces the Vegetation of a Plant, from a Seed to a Tree again producing Seed; which

which Account, as it cannot well be contracted, without leaving out ſomething material; and as it ſerves to ſhew ſome of the excellent uſes of our ingenious Philoſopher's happy Diſcoveries, I ſhall (to conclude this Abſtract) give in the Author's own Words.

" Supported by the Evidence of many of the fore-
" going Experiments, I will now trace the Vegetation
" of a Tree, from its firſt ſeminal Plant in the Seed,
" to its full Maturity and Production of other Seeds,
" without entring into a particular Deſcription of the
" Structure of the Parts of Vegetables; which has
" already been done by Dr. *Grew* and *Malpighi*.

" We ſee by *Experiment* 56, 57, 58, on diſtilled
" Wheat, Peaſe, and Muſtard-Seed, what a wonderful
" Proviſion Nature has made, that the Seeds of Plants
" ſhould be well ſtored with very active Principles;
" which Principles are there compacted together by
" him, who curiouſly adapts all things to the pur-
" poſes for which they were intended, with ſuch a juſt
" degree of Coheſion, as retains them in that State,
" till the proper Seaſon of Germination: For if they
" were of a more lax Conſtitution, they would too
" ſoon diſſolve like the other tender Annual Parts of
" Plants: And if they were more firmly connected,
" as in the Heart of an Oak, they muſt neceſſarily
" have been many Years in germinating, tho' ſupplied
" with Moiſture and Warmth.

" When a Seed is ſown in the Ground, in a few
" Days it imbibes ſo much Moiſture, as to ſwell with
" very great force; as we ſee in the Experiment on
" Peaſe in an Iron-Pot. This forcible Swelling of the
" Lobes of the Seed *a r*, *a r*, (Fig. 1.) does probably
" protrude Moiſture and Nouriſhment from the capil-
" lary Veſſels *r r*, which are called the Seed-Roots,

" into the Radicle *c z d*; which Radicle, when it is thus " ſhot ſome length into the Ground, does then im- " bibe Nouriſhment from thence; and after it has ac- " quir'd ſufficient Strength, as this tender ductile Root " is extending from *z* to *c*, it muſt neceſſarily carry " the expanding Seed-Lobes upwards at the ſame time " that the dilating from *z* to *d* makes it ſhoot down- " wards; and when the Root is thus far grown, it " ſupplies the Plume *b* with Nouriſhment; which " thereby ſwelling and extending, opens the Lobes " *a r*, *a r*, which are at the ſame time raiſed above- " ground with the Plume *i*, where they by expanding " and growing thinner, turn to green Leaves (except " the Seeds of the Pulſe-kind;) which Leaves are of " ſuch importance to the yet tender Plume, that it " periſhes, or will not thrive if they are pulled off: " Which makes it probable, that they do the ſame Of- " fice to the Plume that the Leaves adjoining to Ap- " ples, Quinces and other Fruit do to them, *viz.* they " draw Sap within the reach of their Attraction. (See " *Exper.* 8. and 30.) But when the Plume is ſo far " advanced in growth, as to have Branches and ex- " panded Leaves to draw up Nouriſhment, then theſe " ſupplemental ſeminal Leaves *a r*, *a r*, being of no " farther uſe, do periſh; not only becauſe the now- " grown and more expanded Leaves of the young " Plant or Tree do ſo overſhade the ſupplemental " Leaves, that the former more plentiful Perſpiration " is much abated; and thereby alſo their power of " attracting Sap fails; but alſo becauſe the Sap is " drawn from them by the Leaves; and they being " thus deprived of Nouriſhment, do periſh.

" As the Tree advances in ſtature, the firſt, ſecond, " third and fourth Order of the lateral Branches ſhoot " out, each lower Order being longer than thoſe imme-

" diately

" diately above them; not only on the account of
" Primogeniture, but alſo becauſe being inſerted in
" larger parts of the Trunk, and nearer the Root,
" they have the advantage of being ſerved with great-
" er plenty of Sap, whence ariſes the beautiful para-
" bolical Figure of the Trees.

" But when Trees ſtand thick together in Woods or
" Groves, this their natural Shape is alter'd; becauſe
" the lower lateral Branches being much ſhaded, they
" can perſpirelittle; and therefore drawing little Nou-
" riſhment, they periſh: But the Top-Branches being
" expoſed to a free drying Air, they perſpire plenti-
" fully; and thereby drawing the Sap to the Top,
" they advance much in height. But *vice verſâ*, if
" when ſuch a Grove of tall Trees is cut down, there
" be left here and there a ſingle Tree, that Tree will
" then ſhoot out lateral Branches; the Leaves of which
" Branches now perſpiring freely, will attract plenty
" of Sap; on which account, the Top being deprived
" of its Nouriſhment, it uſually dies.

" And as Trees in a Grove or Wood grow only in
" Length, becauſe all the Nouriſhment is by the Leaves
" drawn to the top, moſt of the ſmall lateral ſhaded Bran-
" ches in the mean time periſhing for want of Perſpira-
" tion and Nutrition: So the caſe is the very ſame in
" the Branches of a Tree, which uſually making an An-
" gle of about 45 Degr. with the Stem of the Tree, do
" thereby beautifully fill up at equal and proper Diſtan-
" ces the ſpace between the lower Branches and the top
" of the Tree, forming thereby as it were a parabolical
" Grove or Thicket; which ſhading the Arms, the
" ſmall lateral Shoots of thoſe Arms uſually periſh for
" want of due perſpiration; and therefore the Arms
" continue naked like the Bodies of Trees in a Grove;
" all the Nouriſhment being drawn up to the tops of

" the ſeveral Branches by the Leaves which are there
" expos'd to the warm Sun and free drying Air, where-
" by the Branches of Trees expand much.

" And where the lateral Branches are very vigo-
" rous, ſo as to make ſtrong ſhoots, and attract the
" Nouriſhment plentifully, there the Tree uſually a-
" bates of its height: But where the Tree prevails in
" height, as in Groves, there commonly its lateral
" Branches are ſmalleſt. So that we may look upon a
" Tree as a complicated Engine, which has as many
" different Powers as it has Arms and Branches, each
" drawing from their common Fountain of Life the
" Root: And the whole of each yearly growth of the
" Tree will be proportionable to their attracting Pow-
" ers, and the Quantity of Nouriſhment the Root af-
" fords But this attracting Power and Nouriſhment
" will be more or leſs, according to the different Ages
" of the Tree, and the more or leſs kindly Seaſons of
" the Year.

" And the proportional growth of their lateral and
" Top-Branhes in relation to each other, will much
" depend on the difference of their ſeveral attracting
" powers. If the Perſpiration and Attraction of the
" lateral Branches is little or nothing, as in Woods and
" Groves, then the Top-Branches will mightily pre-
" vail; but when in a free open Air the Perſpiration
" and Attraction of the lateral Branches come nearer
" to an Equality with that of the Top, then is the a-
" ſpiring of the Top-Branches greatly check'd. And
" the caſe is the ſame in moſt other Vegetables, which
" when they ſtand thick together, grow much in length
" with very weak lateral Shoots.

" And as the Leaves are thus ſerviceable in promo-
" the growth of a Tree, we may obſerve, that Nature
" has plac'd the Pedals of the Leave-ſtalks where moſt

" Nou-

" Nouriſhment is wanting to produce Leaves, Shoots " and Fruit; and ſome ſuch thin leafy Expanſion is " ſo neceſſary for this purpoſe, that Nature provides " ſmall thin Expanſions, which may be called prima- " mary Leaves that ſerve to protect, and draw Nou- " riſhment to the young Shoot and Leaf-buds before " the Leaf it ſelf is expanded.

" And herein we ſee the admirable Contrivance of " the Author of Nature, in adapting her different " Ways of conveying Nouriſhment to the different " Circumſtances of her Productions. For in this *Em-* " *bryo*-ſtate of the Buds a ſuitable proviſion is made " to bring Nouriſhment to them in a Quantity ſuffici- " ent for their then ſmall Demands. But when they " are in ſome degree increaſed and formed, a much " greater quantity of Nouriſhment is neceſſary in pro- " portion to their greater Increaſe: Nature, that ſhe " may then no longer ſupply with a ſcanty hand, im- " mediately changes her Method, in order to convey " Nouriſhment with a more liberal hand to her Pro- " ductions; which Supply daily increaſes by the grea- " ter Expanſion of the Leaves, and conſequently the " more plentiful Attraction and Supply of Sap, as the " greater growth and demand of it increaſes. We find " a much more elaborate and beautiful *Apparatus* for " the like purpoſe, in the curious Expanſions of Bloſ- " ſoms and Flowers, which ſeem to be appointed by " Nature, not only to protect, but alſo to draw and " convey a Nouriſhment to the *Embryo*-Fruit and " Seeds. But as ſoon as the *Calix* is form'd into a " ſmall Fruit now impregnated with its minute ſemi- " nal Tree, furniſh'd with its *Secondine*, *Chorion* and " *Amnion* (which new-ſet Fruit may in that ſtate be " look'd upon as a compleat Egg of the Tree, yet in " Embryo) then the Bloſſom falls off, leaving this

new-

" new-form'd Egg or firſt-ſet Fruit in this Infant-ſtate,
" to imbibe Nouriſhment ſufficient for it ſelf, and the
" *Fœtus* with which it is impregnated : Which Nou-
" riſhment is brought within the reach and power of
" its Suction by the adjoyning Leaves.

" If I may be allow'd to indulge Conjecture (in a
" Caſe, in which the moſt diligent Inquirers are as
" yet, after all their laudable Reſearches, advanced
" but little farther than meer Conjecture) I would
" propoſe it to their conſideration, whether from the
" manifeſt Proof we have that Sulphur ſtrongly at-
" tracts Air, a hint may not be taken to conſider whe-
" ther this may not be the primary uſe, of the *Farina*
" *fœcundans*, to attract and unite with it ſelf elaſtick
" or other refin'd active Particles.

" That this *Farina* abounds with Sulphur, and that
" a very refin'd ſort, is probable from the ſubtil Oil
" which Chymiſts obtain from the Chives of Saffron.
" And if this be the uſe of it, was it poſſible
" that it could be more aptly placed for the
" purpoſe on very movable *Apices* fixed on the ſlender
" Points of the *Stamina*, whereby it might eaſily with
" the leaſt breath of Wind be diſperſed in the Air,
" thereby ſurrounding the Plant as it were with an At-
" moſphere of ſublimed ſulphureous Pounce ? For many
" Trees and Plants abound with it ; they may be per-
" haps inſpir'd at ſeveral parts of the Plant, and eſpe-
" cially at the *Piſtillum*, and be thence conveyed to
" the *Capſula ſeminalis*, eſpecially towards Evening;
" and in the Night, when the beautiful *Petala* of the
" Flowers are cloſed up, and they, with all the other
" parts of the Vegetable, are in a ſtrongly imbibing
" ſtate. And if to theſe united ſulphureous and aerial
" Particles we ſuppoſe ſome Particles of Light to be
" joyned (for Sir *Iſaac Newton* has found that Sulphur
" attracts

" attracts Light ſtrongly) then the reſult of theſe
" three by far the moſt active Principles in Nature,
" will be a *Punctum Saliens* to envigorate the *Seminal*
" Plant: And thus we are at laſt conducted by the
" regular Analyſis of vegetable Nature to the firſt
" enlivening Principle of their minuteſt Origin.

P. S. *Since I began this Abſtract, I was with the ingenious Author, who by ſome Experiments try'd ſince the writing of his Book, was become certain of ſome things which he ſpoke doubtfully of before*, viz, 1. *That the Diaphragm-Inſtrument (ſee Page* 263, *of his Book) wou'd ſerve to breathe* 8 ½ *Minutes when it was entirely dry, and the Diaphragms impregnated with Salt of Tartar.* 2. *That Leaves imbibe Air, as he has ſince tried in Mint in the manner that he mention'd (in Page* 329.) 3. *That this year the Heat of the Weather has been at* 84 *Degrees, mark'd on his Thermometers.*

F I N I S.

Advertiſement.

WHereas I publiſh'd a Paper concerning the Figure of the Earth, in the *Philoſophical Tranſactions*, Numb. 388, and a Paragraph which I cancell'd, was, by the miſtake of my *Amanuenſis*, printed whilſt I was ſick: I deſire ſuch Readers as have that *Tranſaction* by them, to cancel from the Words, *Laſtly, Let us ſuppoſe*, Page 280. Lin. *ult.* to the End of the Paragraph.

Having from time to time neglected to give this notice, I choſe to do it here, tho' late, rather than wholly to omit it.

J. T. Deſaguliers.

Philo: Trans:

N.° 400.

Fig. 1.

Fig. 2.

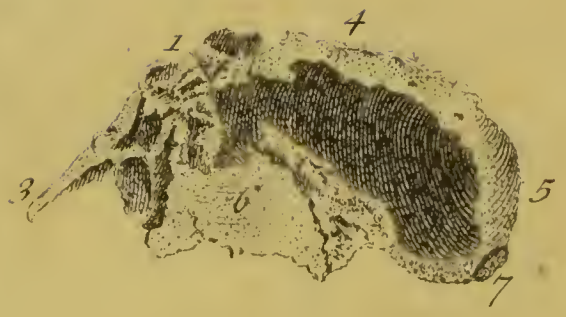

Fig. 3.

Fig. 4.

Numb. 400.

PHILOSOPHICAL TRANSACTIONS

For the Months of *October*, *November*, and *December*, 1727.

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XI. *Ingens Materiæ Purulentæ copia cariem & ſeparationem totius* Oſſis Mali, *&c. inducens, & per triennium ex Ore Pueri defluens, obſervata à Domino* Petro Hardiſway, M. D.

I. *Ob-*

I. *Obſervatio* Solaris Deliquii *celebrati Die* 25. *Septemb.* 1726. *habita* Ulyſſipone *in Obſervatorio Regii Palatii* A' P. Jo. Baptiſta Carbone, *Soc. Jeſ.*

CŒlo, præter ſpem, clariſſimo Deliquium hoc Ulyſſipone conſpeximus, ejuſque finem tantum non vidimus; monte ſiquidem interjecto, delituit Sol uno circiter minuto temporis antequam plenè reſtitueretur. Ad id ego obſervandum Teleſcopio uſus ſum pedum 8. Pariſinorum, quod micrometro inſtruxeram accuratiſſimè elaborato. Nonnulla tamen obſervanti acceſſerunt incommoda, quibus præpedientibus, macularum Solarium (quamplures eo die videbantur in Sole) Immerſiones, atque Emerſiones, quin & phaſes aliquot digitorum inveſtigare, aut opportunè adnotare non licuit. Quas tamen obſervare datum eſt, eas ſanè ſenſibili errore carere autumo; tum quòd in digitis Solaribus rectè dimetiendis nullam prætermiſſerim diligentiam; tum quod correctionem temporis (cui potiſſimum nititur hujuſmodi Obſervationum veritas) repetitis eo die Obſervationibus accuratiſſimè inveſtigaverim. Ne verò ſuo careat teſtimonio prædicta correctio, duas hîc apponam altitudines Solis, quarum alteram ante Eclipſeos initium, alteram ſub ejus finem, Quadrante Aſtronomico trium pedum Pariſinorum, deprehendi; & utraque ſanè Obſervationi Meridianæ conſentit, ejuſdemque defectûs horologium arguit.

	H.	′	″
In Meridie verò, ſeu Apparenti indicabat horologium. - - - - - - -	11	58	34
Nempe deficiebat à Tempore vero - -		1	26

	°	′	″
A' Meridie; Altitudo vera centri Solis	28	53	45
Ejuſdem Declinatio Auſtralis - - -		53	18
Altitudo Poli, ex pluribus Obſervationibus, certa, ſaltem quoad minuta prima	38	42	0
Quibus datis invenitur per Trigonometriam arcus diſtantiæ Solis à Meridiano	50	49	36

	H.	′	″
Qui, ſi in tempus convertatur, dat - -	3	23	18
Indicabat verò horologium - - - - -	3	21	48
Ergo à tempore vero deficiebat - - -		1	30

	°	′	″
Iterum, Altitudo vera centri Solis - -	4	52	54
Ejuſdem Declinatio Auſtralis - - -		55	24
Altitudo Poli, ut ſupra - - - - -	38	42	0
Ex quibus denuò per Trigonometriam infertur arcus diſtantiæ Solis à Meridiano	82	59	40

	H.	′	″
Qui in tempus converſus, dat - -	5	31	59
Indicabat verò horologium - - -	5	30	26
Ac proinde à tempore vero deficiebat - -		1	33

Hanc igitur æquationem tempori horologii prudens addidi, quò fieret tempus verum, ſeu apparens correctum, eoque uſus ſum in ſequentibus Obſervationibus.

	Temp. Ver. H.	′	″
Incipit limbus Lunæ limbum Solarem perſtringere. *dub.* - - - - - - - -	5	59	50
I. Digitus latet - - - - - - - -	4	5	10
II. Digitus - - - - - - - - - -	4	10	45
III. Digitus - - - - - - - - -	4	16	55
Dimidium quarti - - - - - -	4	20	14
IV. Digitus - - - - - - - - -	4	23	48

V. Di-

	H.	′	″
V. Digitus	4	31	5
Dimidium ſexti	4	34	51
VI. Digitus	4	38	57
VII. Digitus	4	47	57
Dimidium octavi	4	54	59
Maximæ obſcurationis tempus, quantum ex reliquis phaſibus colligi poteſt	4	58	30
Ejuſdem verò Quantitas, dig. 7. min. 45. nempè revolutiones cochleæ 11. & $\frac{1}{18}$, quarum 18. integras præcontinebat Diameter Solis.			

Emersio.

	H.	′	″
Dimidium ſeptimi digiti latet	5	13	40
VI. Digitus	5	17	58
V. Digitus	5	25	58
Dimidium quinti	5	29	43
Dimidium quarti	5	36	49
III. Digitus	5	40	8
Dimidium tertii	5	43	14
II. Digitus	5	46	10
Dimidium ſecundi	5	48	58
I. Digitus	5	51	40
Limbus Solis inferior montem ſtringit.	5	52	42
Sol totus deliteſcit, adhuc deficiens min. circiter 12. nempè $\frac{1}{5}$ unius digiti.	5	55	27

	H.	′	″
Altitudo apparens montis, ſeu limbi ſuperioris Solis, 57′ 30″, quæ correcta, erit 34′ 29″; ex his rurſus ſubtractâ quantitate ſemidiametri Solaris 16′ 4′ remanebit, altitudo vera centri Solis, quando totus delituit 18′ 25″; ex qua, reliquis etiam datis, infertur per Trigonometriam hora prædictæ altitudini reſpondens, nimirùm - - - - - - - - -	5	55	27
Occaſus Solis verus - - - - - -	5	57	1
Sed apparens, propter refractionem, circ.	6	0	0
Unde patet, finem Eclipſeos in noſtro Hemiſpherio viſibilem fuiſſe; contigit enim, quantùm ex prædictis colligi poteſt, circiter. - - - - - - - - -	5	56	50

II. Lunaris Eclipſis *celebrata die* 10. *Octob. an.* 1726. *& in Obſervatorio Collegii* D. Antonii Magni *obſervata ab* Eodem.

INnumeris ea nocte vaporibus inficiebatur aër, qui ſpiſſiores in nubes paulatim denſabantur, ipſamque Lunam non mediocriter offuſcabant. Verebar proinde, ne non bene mihi, ac feliciter Lunaris Defectus Obſervatio contingeret; futurum enim obnubilum tota ea nocte cœlum videbatur. Sub mediam verò noctem, Euro-Borea ſpirante, ſenſim aër diverberari, mox etiam diſpergi nubes viſæ ſunt; atque horâ circiter ſecundâ Occidentalis plaga, ad quam Luna vergebat, nitidiſſima apparuit, eademque ad finem Eclipſeos permanſit. Nullo igitur

igitur aëris incommodo Obſervationem hanc habui; nec quidquam prætermiſi, quod ejus rectitudini favere quoque modo intelligerem. Eodem uſus ſum Teleſcopio, quo in Obſervatione Solaris Deliquii; idemque adhibui micrometrum in definiendis Digitis Obſcurationis.

Ad Temporis verò dimenſionem horologio uſus ſum, pendulo inſtructo; cujus tanta æqualitas motus, ut dierum intervallo decem, & octo, vix uno, aut altero ſecundo à Medio Solis motu diſcrepaſſe deprehenderim; idque accuratiſſimo, ac quotidiano penè examine per appulſum fixæ ad eundem verticalem. Ejus differentiam à Tempore Vero, ſeu Apparenti repetitis interdiù Obſervationibus inveſtigavi, tùm ſcilicet per Solis altitudines, tum per lineam Meridianam; quas tamen Obſervationes libens prætereo, ne longior ſim; ejuſmodi enim ſunt, atque exhibitæ in præcedenti Solaris Eclipſeos Obſervatione.

Macularum nomina ex Selenographia P. Grimaldi excerpta ſunt, quam P. Ricciolius ſuo Almageſto novo inſeruit, ac nominibus locupletavit. In eorum verò commodum, qui Hevelianam ſequuntur Nomenclaturam, ſynonymas quoque voces, ex hoc Authore deſumptas, ſecundo loco apponam, præpoſita litera H, quæ Hevelium ſignificat.

	Temp. V. cor. H. ′	′′	′′
Incipit penumbra ſenſibilis limbum Lunæ ad Euro-Auſtrum inficere. - -	14	37	0
Spiſſior apparet - - - - - - - - -	14	46	0
Spiſſiſſima - - - - - - - - - - -	14	56	0
Umbra Terræ, quantum diſcerni poteſt, ad eundem limbum pertingit - -	14	57	20
Schikardus in Umbra - - - - - -	15	3	50

	o	′	″
I. Digitus obumbratur - - - - -	15	4	53
Umbra ad *Kriſtmanùm* - -	15	8	4
Immergitur totus - - - - - -	15	9	15
Merſenius latet: Litus Orientale *Maris humorum* incipit obumbrari: H. *Sinus Sirbonis* - -	15	9	50
II. Digiti latent - - - - - - -	15	13	0
Capuanus immergitur - -	15	13	36
Ad *Grimaldum* pervenit Umbra: H. *Pal. Mareotis* - - -	15	14	54
Gaſſendus incipit obumbrari -	15	17	34
Incipit *Tycho*: H. *Mons Sinai*. *Grimaldus* latet. - - - - -	15	19	46
Tychonis medium tenet Umbra.	15	21	0
III. Digiti. *Tycho* totus immergitur -	15	21	53
Morinus: H. *Caſſius* - -	15	23	58
Bullialdus H. *Inſula Creta* -	15	25	20
Profatius incipit obumbrari -	15	30	58
IV. Digiti - - - - - - - - -	15	31	48
Profatius latet. - - - - -	15	32	40
V. Digiti - - - - - - - - - -	15	43	40
Umbra tantum non attingit *Galilæum*, quem propter diutiſſimè verſatur - - - - - - - -	15	48	0
Ad *Snellium*, & *Fornerium* pervenit Umbra - - - - -	15	53	20
Ad *Fracaſtorium*. *Snellius* & *Fornerius* latent - - - - -	15	55	38
Fracaſtorius totus in Umbra -	15	58	30
VI. Digiti - - - - - - - - -	16	3	4
Sinum Æſtuum tangit Umbra: H. *Mare Adriaticum* - - -	16	6	13

Medium

	H.	′	″
Medium *Vendelini* - - -	16	8	22
Totum *Mare Nectaris* in Umbra. H. *Sinus extremus* - -	16	14	40
Grimaldus incipit emergere -	16	15	51
Ricciolius extra Umbram - -	16	16	18
Grimaldus totus - - - - -	16	23	30
Umbra ad *Langrenum* - -	16	24	27
Gaſſendus reſtituitur - - -	16	43	34
V. Digiti deficiunt - - - - - -	16	47	22
Bullialdus incipit emergere -	16	51	57
Totus extra Umbram - - - -	16	53	47
Kriſtmanus incipit - - -	16	54	17
Item *Schikardus* - - - -	16	58	0
IV. Digiti. Totus *Schikardus* - -	16	59	27
Pitatus totus - - - - - -	17	3	30
III. Digiti - - - - - - - - -	17	9	20
Tycho incipit emergere - -	17	10	54
Tychonis medium extra Umbram	17	11	49
Tycho totus emergit - - -	17	12	40
Fracaſtorius totus - - - -	17	14	20
II. Digiti - - - - - - - - -	17	18	4
Snellius emergit - - - -	17	25	43
I. Digitus tantum latet - - - -	17	26	10
Fornerius extra Umbram - -	17	27	55
Extremus limbus Lunæ, qui ad Africum ſpectat videtur proximè emerſurus - - - - - - - -	17	32	50
Jam Lunæ diſcus integer apparet, ac proinde Finis Eclipſeos	17	33	30
Adhuc denſiori penumbra prædictus limbus inficitur - - -	17	38	0

Definit

	H.	′	″
Definit penumbra ſenſibilis, ſuæque Luna claritati omninò reſtituta apparet - - - - - - - - -	17	54	0

	H.	′	″
Ex obſervatis Initio, ac Fine Eclipſeos colligitur ejus Duratio - - - - -	2	36	10
Medium verò, ſeu Maxima obſcuratio.	16	15	25
Quantitas Micrometro diligenter inveſtigata, Dig. 6. min. 10′. - - -			

Terreſtris Umbra in hac Eclipſi tum malè terminata, quod in cæteris Lunæ Eclipſibus contingere ſolet, tum etiam ſubluſtrior, atque aliàs viſa eſt. Difficilior proinde veri Initii, Finiſque inveſtigatio fuit; nec ſuo carituras arbitror diſſidio diverſas Aſtronomorum Obſervationes, qui ſcilicet in eodem penumbræ termino definiendo perquam rarò conveniunt; ac tum vel maximè, quando nulla Terreſtris Umbræ portio in diſco Lunari verſatur, uti nulla verſari incipiente Eclipſi, vel deſinente poteſt. Reliquæ verò phaſes, faciliùs, ac citra ſenſibilem errorem determinari potuerunt, comparatione habita inter Umbram veram, ac ſpiſſiorem penumbram. Equidem, ut rectitudini Obſervationis, quoad fieri poterat, diligentiſſimè conſulerem, plura ſub Eclipſeos Initium, plura ſub ejus Finem momenta temporis adnotavi; quorum ea tandem vero Initio, ac Fini adſcripſi, quæ utrique maximè congruere ex pluribus circunſtantiis deprehendi.

III. *Re-*

III. *Remarks upon ſome Experiments in* Hydraulics, *which ſeem to prove, that the Forces of equal moving Bodies are as the Squares of their Velocities.* *By Mr.* John Eames, F. R. S.

THE Reſult and Subſtance of theſe Experiments is, That the Velocities of any Fluid, for Inſtance Water, iſſuing out at equal Orifices made in the Sides of Tubes, or Veſſels filled up to different Heights, and kept full at thoſe Heights, above the Orifices, are found to be as the ſquare Roots of thoſe Heights reſpectively. Thus, when the different Heights above the Orifices are as the Numbers 1, 4, 9, 16, *&c.* the Velocities of the Particles of Water, iſſuing out, are found to be as the Numbers 1, 2, 3, 4, *&c.*

The Argument drawn from theſe Experiments, in Favour of the Opinion, that the Forces of equal Maſſes, or moving Bodies, are proportional to the Squares of their Velocities, runs thus. All the Particles of Water, being of the ſame Nature, and uniform, every ſingle Particle iſſuing out with Two Degrees of Velocity, muſt move with 4 Times the Force of any other ſingle Particle, that moves but with One Degree of Velocity; becauſe the Force with which it moves, is the Effect of a Cauſe 4 Times greater; namely, the Preſſure of a Column of Water, whoſe Height is 4 Times greater.

Thus, again, a Particle of Water running out, with 3 Degrees of Velocity, muſt move with 9 Times the Force of a Particle moving with but 1 Degree of Velocity; becauſe that Force is the Effect of a Cauſe 9 Times greater, *viz.* the Preſſure of a Column 9 Times higher:

Since no leſs than a Column 9 Times higher, is found, by Experience, neceſſary to make the ſeveral Particles of Water iſſue out with 3 Degrees of Velocity. So that, in theſe Two Inſtances, it ſeems to be certain, that the Forces communicated, are as the Squares of the Velocities. And that it is ſo univerſally, is argued thus: The Preſſures are as the Altitudes, and the Altitudes as the Squares of the Velocities of every ſingle Particle; therefore the Preſſures are as the Squares of the Velocities; but the Preſſures are the Cauſes of the Forces, with which the ſeveral Particles of Water iſſue out, or move; and therefore ſince Effects are proportional to their Cauſes, the Forces with which the ſeveral Particles iſſue out, and move, are as the Squares of the Velocities.

REMARK I. The Fault committed in this Reaſoning, and which quite runs through it, is the miſtaking a Part of the Effect for the Whole. The entire Effect of any of theſe Preſſures is, not barely a certain Number of Degrees of Velocity, in any ſingle Particle, but certain Degrees of Velocity in a certain Number of Particles, and that certain Number of Particles, in a given Time, is, confeſſedly, as the Degrees of Velocity.

REMARK II. And this leads me to a Second Remark, which is, That the entire Effect of theſe Preſſures being taken into Conſideration, ſeems to overturn this new Rule in Mechanicks for computing the Forces of moving Bodies, which is, *That the Forces are as the Quantities of Matter multiplied by the Squares of the Velocities.* And this I ſhall endeavour to make out thus: The Gentlemen who advance this new Rule, at the ſame Time that they aſſert the Velocities, in the Caſes of the Experiment above-mentioned, to be as the

Square

Square Roots of the Altitudes, do alſo confeſs, that the Quantities of the Fluid, preſſed out in equal Times, are as thoſe Velocities. For thus an ingenious Profeſſor abroad tells us in his *Epitome Element. Phyſ. Math.* Part. 2da. Cap. iv. p. 665. " *Quantitates fluidorum ex* " *utroque vaſe exeuntium in eodem tempore ſunt inter* " *ſe velut celeritates, adeoque in ſubduplicata ratione* " *altitudinum fluidorum ſupra foramina.* Now if this be true, that the Quantities of Water flowing out in equal Times, are as the Velocities, then the Forces cannot be as the Quantities of Matter multiplied by the Squares of the Velocities: For then the Effects, inſtead of being proportional, would be more than in Proportion to their Cauſes. Thus, the Effect of a Preſſure of a Column of any Fluid, as Water, 9 Inches high, inſtead of being but 9 times greater than that of 1 Inch above the Orifice, will be no leſs than 27 Times greater. For the Velocity being at this Height triple, the Quantity of Matter in a given Time will alſo be triple; which laſt, multiplied by the Square of the Velocity, gives 27 for the Force communicated by a Preſſure of 9 Inches in Altitude, while the Force communicated by the Preſſure of 1 Inch, is but as 1. So that the moving Forces produced will be as 27 to 1, while the Cauſes producing theſe Forces, are but as 9 to 1, *i. e.* Three Times too little for ſuch a Purpoſe.

Thus again, if the Velocities be as 1 and 4, the Quantities of Water iſſuing out will be as 1 and 4; but the Effects, or Forces produced, according to the new Rule, will be as 1 and 64; though the Preſſures, which communicate them, are but as the Altitudes, which are as 1 and 16. Whereas, to produce ſuch Effects, the Altitudes of the latter Column ought to have

been as 64; *i. e.* 4 Times greater than by Experience it is found to be.

REMARK III. I cannot but obſerve, in the laſt Place, that the common Rule of eſtimating the Forces of moving Bodies by the Quantities of Matter multiplied by their Velocities, is rather confirmed by theſe very Experiments. For then, according to the old Maxim, Effects are proportional to their Cauſes, the Forces communicated will be as the Forces communicating, or Preſſures. Thus let the Altitude, and conſequent Preſſure of any Column of Water be 9 Times greater than the Altitude of another; then the Velocity of every ſingle Particle of Water preſſed out will be triple, and the Number of Particles iſſuing out in a given Time will likewiſe be triple; therefore the Force reſulting from theſe Two multiplied together, according to the common Rule, will be 9, proportional to the Preſſure, as it ought to be. So again, if the Altitude be 16 Times greater, the Velocity will be quadruple, and the Number of the Particles quadruple, and the Force produced the Product of theſe Two; *i. e.* 16, ſtill proportional to the Altitude, or Preſſure.

And univerſally, the Forces communicated, according to the old Rule, are in a Ratio compounded of Two others, One of the Quantities of Matter, and the other of the Velocities: The Ratio of the Velocities, by the Experiments, is the Subduplicate Ratio of the Heights, and the Ratio of the Quantities of Matter is, by Confeſſion, likewiſe the Subduplicate of the Heights: Therefore the Compound of theſe 2 is the Ratio Integra, or ſimple Ratio of the Heights; in which Ratio are the Preſſures themſelves, which produce theſe moving Forces: So that, according to the common Rule, the Effects are always,

always, as they ought to be, proportional to their Cauſes.

After the ſame Manner the ingenious Mr. *Graveſande* once argued ; for thus he reaſons in Paragraph 355 of *Phyſices Elem. Mathematica*, Firſt Edition.

" *Non tamen eandem cum profunditate proportio-*
" *nem ſequitur Velocitas, licet preſſio, ex qua Veloci-*
" *tas oritur, in eadem ratione cum profunditate*
" *creſcat. Quantitas motûs quæ in liquido produci-*
" *tur, eſt effectus totus preſſionis, & hæc quantitas*
" *ad inſtar preſſionis augetur. Ratio autem quanti-*
" *tatis motûs eſt compoſita ex ratione Velocitatis, &*
" *quantitatis materiæ motæ, hìc materia mota eſt a-*
" *qua, quæ ex foramine exit, cujus quantitas, ma-*
" *nente tempore, cum celeritate creſcit ; dupla erit,*
" *ſi hæc dupla fuerit, in quo caſu motûs quantitas eſt*
" *quadrupla, id eſt, augetur ut quadratum celerita-*
" *tis, quod poſitâ celeritate quacunque ſemper obti-*
" *net ; creſcit ergo hoc quadratum ut preſſio, id eſt, ut*
" *altitudo liquidi ſupra foramen ex quo profluit aqua.*

IV. *A Copy of a Letter from Dr.* David Kinneir, Coll. Med. Edingb. Soc. *to Dr.* Campbell, Coll. Med. Lond. Soc. Honorar. *touching the Efficacy of* Camphire *in* Maniacal *Diſorders.*

SIR,

IN Converſation, t'other Day, on the Subject of our Profeſſion, I told you how ſucceſsfully I had us'd Camphire in *Maniac* Diſorders, which hitherto never

has fail'd my Expectation in the *Mania*, and other Caſes wherein the *Genus Nervoſum* and Blood ſeem to be affected after the ſame Manner, but in a leſs Degree. At your Requeſt, I ſend you the Hiſtory of Four Caſes, with all the Exactneſs my Memory can afford. I own I flatter my ſelf, that from the Effects of this Medicine Phyſicians may be led into a more ſure Way of Reaſoning in *Nervous Diſorders*, and therefore give you Leave to publiſh theſe Hiſtories, if you think they may be of Uſe to the Publick.

I. A *Gentlewoman of Nineteen Years of Age*, from an obſtinate Faſting for Two Days, and Averſion to ſee Company, in a religious Turn before *Eaſter*, fell into a deep Melancholy, would not talk, nor anſwer any Queſtion for ſome Time, but moan'd and ſigh'd continually; ſlept very little for Ten Days. This happen'd in the *Decline* of the Moon. The Night before the *Change* ſhe ſpoke, and call'd for ſome Water to drink, which being given her, ſhe immediately fell a ſtarting and laughing, and her Eyes got a Briskneſs in them ſomewhat uncommon, (as her Relations told me) then began to talk wildly, and continu'd ſo all that Night. She became next Morning very furious; whereupon a Phyſician was call'd, who bled her Four Times a Week the firſt Fourteen Days, vomited her, purg'd her, us'd the *Cold Bath*, and many other Methods common in ſuch Caſes, all to no Purpoſe. In this Condition ſhe continu'd for Nine Months; then I was apply'd to.

I firſt began her with an Antimonial Vomit, which had no other Effect than that of ſetting her faſt aſleep for Twelve Hours. Next Day I gave her ~~9 Scruples~~ of *Camphire* in a *Bolus*, and as much at Night. She continu'd to reſt well all that Night, and had a great Moiſtneſs all over

over her Body, and in the Day-time a plentiful Diſcharge by Urine. Thus for Four Days I ply'd her, and afterwards, in the Day-time, I order'd her Pills of *Æthiops*, *Gum-guaiac. Cinnab. Antim. & pulv. de Gutteta*; and at Night, the Doſe of *Camphire*. Senſible Alterations every Day for the better, and in Three Weeks Time ſhe enjoy'd the full Uſe of her Reaſon, and tho' Nine Years ago, at this Time is in a very good State of Health, having no extraordinary Ailing ever ſince.

II. A *Gentleman* of a good Family, *aged Seventeen Years*, (from ſome Diſappointment) became very ſilly and ſtupid. He continu'd in that Way for a long Time, notwithſtanding he had the beſt Advice. He had a great Inclination to chaw and eat every thing that came in his Way, be it what it would. He reſted pretty well a Nights, and was delighted with the Sight of every glaring Object. He hid every thing he could lay his Hands on, as well in Company as alone, and not any ways ill-natur'd. Thus for Half a Year he continu'd, when he became ſo furious, that Two Men could hardly hold him from beating every Body that came about him. Thus he would continue for Three or Four Days together, without ſleeping; then he would become calmer, after having ſlept ſome Time; but was a little miſchievous. This was the Way from *New Moon* till the *Full*; then he became ſilly and melancholly, ſpeaking little, and looking always down, not caring to look one in the Face. So it was *alternately* for Fourteen Months.

When I came to him, I found him full of Complaints of his ill Treatment; and had not I had a watchful Eye upon him, I had ſuffer'd from a Blow intended at me; but I got him to take the *Medicines* as *before*, and

and with allowing him a more plentiful Diet, and a great Quantity of *Diluting Drinks*, he became perfectly well in Six Weeks, and has enjoy'd a good State of Health and ſound Judgment theſe ſeveral Years, and is now in Buſineſs.

III. A *Mercer's Wife* of *Thirty Six Years of Age*, having born Four Children, and who was naturally of a lively, active Diſpoſition, fell ſo ill, all of a ſudden, One Day at Sermon, that with much ado they could get her out of Church with common Decency. She tore every thing about her, talk'd much, and utter'd horrid Oaths. In Fine, ſhe was as much diſorder'd as you can imagine any one. She had the beſt Advice, 'twas thought, that *Edinburgh* could give her. They fail'd of Succeſs, and left off viſiting her. About Half a Year thereafter I was conſulted about her. I treated her in the *foregoing* Manner, and in Four Days there was a ſenſible Alteration for the better, and in Four more ſhe went abroad. I ſtill continu'd the Uſe of the Medicines for Fourteen Days after Recovery, and now ſhe is as well as ever ſhe was in her Life.

IV. A *young Man, aged Twenty*, of a full Habit, was ſo very bad in the ſullen, deſpairing Way, wounding himſelf with his Teeth and Hands, that there was a Neceſſity of cloſe watching him. I *vomited* him twice, gave him ſome other Things common in ſuch Caſes; then began him with the *Camphire*, which in Ten Days brought him to Reaſon. He relaps'd after that on the *Change* of the Moon, was ill for Three Days, but not ſo as before. He came out of it again, and ſtood the *Change* of the next Moon with only a little Heavineſs, as in the *Hypo*. At the Height of the ſame Moon, the Day before, he was very uneaſy, and ſeem'd

to

to reſemble a Perſon greatly *hypochondriac*. I ſtill continu'd to him the *Camphire*, and the other *alterative Medicines*, for ſome Time, but in a much ſmaller Doſe than what I gave him in his Illneſs: So in Nine Weeks he was perfectly cur'd, and continues in good Health.

This, Sir, is the Subſtance of what I remember of the preceding Caſe, wherein I lay'd the whole Streſs of the Cure on *Camphire*.

I am, &c.

V. *A Method for determining the Geographical Longitude of Places, from the Appearance of the common Meteors, called* Falling Stars, *propoſed by* George Lynn, *Eſq; of* Southwick, Northampton-ſhire, *in a Letter to Dr.* Jurin, R. S. & Coll. Med. Soc.

SIR,

UPon peruſing, lately, the Account which the very ingenious Dr. *Halley* has given in the *Tranſactions*, N°. 360, of that extraordinary Meteor which appear'd all over *England*, 19th of *March*, 171⅝. I obſerve One very great Uſe he ſuggeſts might be made of thoſe momentaneous *Phænomena*, in determining the Geographical Longitude of Places, if we could but have the leaſt Notice of their appearing, *&c.*

I cannot but think, that ſome other Meteors which are very frequent, tho' little taken Notice of, might ſerve very well for the ſame Purpoſe. I mean thoſe which are vulgarly call'd *Stars ſhooting*, or *falling*, being a Sort of natural *Sky-rockets* diſcharg'd at a very great

Height, as I cannot but imagine from this Circumſtance, that they never appear, any of them, according to the beſt of my Obſervation, where the Sky is cloudy; and therefore, in all Probability, their Exploſion is in the Regions far above the Clouds, and they themſelves of the ſame Nature with (tho' perhaps leſs, and much lower than) that great Meteor above-mention'd, whoſe Height Dr. *Halley* computes to have been above 60 Geographical Miles, *viz.* much above the ('till then) reputed Limits of our Atmoſphere. But ſuppoſing theſe I mention to be diſcharged only at 20 or 30 Miles high, they may be ſeen by different Obſervers at the ſame Moment of abſolute Time, in very diſtant Places from one another, which is the Thing required: For, if in any Two Places, as the Doctor takes Notice, any Two Obſervers, by Help of Pendulum Clocks duly corrected by celeſtial Obſervations, do exactly note at what Hour, Minute, and Second, ſuch a Meteor is diſcharged, the Difference of thoſe Times will be the Difference of Longitude of the Two Places; nor does it require ſo much as the Uſe of a Teleſcope, as in the Methods hitherto put in Practice for that Purpoſe. Now theſe natural *Rockets* I have found to be very frequent in every Star-light Night; but eſpecially after a ſtormy Day, or in a ſtormy Night. If, therefore, Perſons who are prepared, as above, to be exact in their Time, and alſo have a moderate Knowledge of the ſeveral Conſtellations, ſo as to deſcribe the Track of any of thoſe Meteors amongſt the Stars, would but beſtow any determinate Hour to be agreed amongſt them, as for Inſtance, from 8 to 9 each ſuch Night, to watch and obſerve thoſe Exploſions, noting down immediately the Time and Track of them, it would be eaſy to determine,

termine, upon comparing their Obſervations, which of thoſe Exploſions each of them ſee at the ſame Time; and thereby the Difference in Longitude of thoſe Places would be exactly had, as above. It would, however, be worth the While, this Way, to try whether ſuch common Meteors are diſcharged, at any conſiderable Height above the Clouds, and how far, and whether they differ much from one another in their Heights.

But theſe Speculations I leave, Sir, to your better Judgment, either to improve the Hint, if it deſerves it, or if not, entirely to ſuppreſs it; and in either Caſe remain

Yours, &c.

VI. *An Attempt made before the* Royal Society, *to ſhew how Damps, or foul Air, may be drawn out of any Sort of* Mines, &c. *by an* Engine *contriv'd by the Reverend* J. T. Deſaguliers, L. L. D. *and* F. R. S.

THE *Engine* repreſented by the *Model*, conſiſts of a Triple *Crank* working 3 *Pumps*, which both ſuck and force Air, by Means of 3 *Regulators*, and are alternately apply'd to drive Air into, or draw it from any Place aſſign'd, thro' ſquare wooden Trunks; which being made of ſlit Deal, and 10 Inches wide in the Inſide, are eaſily portable, and joyn'd to one another without any Trouble.

EXPERIMENT I. I fill'd a tall cylindrick Glaſs with the Steams of a burning Candle and burning Brimſtone Matches, in ſuch Manner that a lighted Candle

would go out almoſt as ſoon as it was let down into that foul Air. Then fixing the Trunks (or ſquare Pipes) to the forcing Hole of the Engine, I drove freſh Air into the Bottom of the above-mention'd Receiver; ſo that the foul Steam came out at the Top of the Receiver, which was open.

EXPERIMENT II. Having fill'd another Receiver (cloſe at Top) with foul Steams, as before, I plac'd it in a Poſition almoſt horrizontal, only with the cloſe End ſomething above the open End, that the foul Steam might not go out of it ſelf, when ſpecifically lighter than common Air. I fix'd the Trunks to the Sucking-hole of the Engine; and by working the Engine, drew out the foul Steams from every Part of the Receiver, as the Trunks were applied to them ſucceſſively.

EXPERIMENT III. Having fill'd with foul Steams, and ſet upright (as in the firſt Experiment) the cylindrick open Receiver, I applied the Trunks to the ſucking Part of the Engine, with their open End near the Bottom of the Receiver. Then, by pumping, the Steams were all drawn downwards, and ſo out at the Top of the Trunks at the Engine; whereas, in the firſt Experiment, they were driven out at the Top of the Receiver.

EXPERIMENT IV. Having ſet a Candle in the cylindric Receiver above-mention'd, without having fill'd it with Steams, and let down the Trunks into the Receiver, below the Flame of the Candle, I laid the wet Leather over the Mouth of the Receiver, leaving about Half an Inch open, for the Air to come in; notwithſtanding which the Candle began to dwindle, and be ready to go out; but working the Engine with the Trunks

Trunks joyn'd to the forcing Part, the Candle reviv'd, and burn'd, at laſt, as well as in the open Air. When I had left off Pumping, the Flame of the Candle diminiſh'd again; but when it was ready to go out, it reviv'd again, upon forcing in more Air with the Engine.

REMARKS *upon the* EXPERIMENTS.

WHEN Damps in Mines are ſpecifically lighter than common Air, they will be driven out of the Mine by the firſt Experiment.

When Damps are ſpecifically heavier than common Air, they may be ſuck'd out by the Second or Third Experiment.

When a *Sough*, or *Adit*, is carried from a Mine to any diſtant Valley, to diſcharge the Water, or ſave the Trouble of raiſing it quite to the Top of the Pit, *Shafts*, or perpendicular Pits are generally ſunk from the Surface of the Earth to the ſaid Sough, to prevent the Workmen from being ſuffocated as they dig the Sough, and that at a great Expence; but, by the 4th Experiment, freſh Air may be driven down to the Workmen, to continue their breathing free and ſafe, and to keep in their Candles; by which Means the Expence of perpendicular Shafts will be ſav'd.

It has been found by ſeveral Experiments, that a Man may breath a Gallon of Air in One Minute, and a Candle of Six in the Pound will burn nearly as long in the ſame Quantity of Air; therefore the Model only is capable of ſupplying freſh Air to One Man; and conſequently, a large Engine will abundantly ſupply Air for the burning of Candles, and the Working of a great Number of Men in a Mine.

One Man may work an Engine like the Model, and bigger every way in the Proportion of a Foot to an Inch.

As at every Stroke, 14 *cylindrick* (or 11 *cubic*) Feet of Air are driven in, or as many cubic Feet of Damp ſuck'd out, if the Axis of the Cranks be turn'd round 60 Times in a Minute, one Man, in that Time, may change the whole Air in a cubic Space, whoſe Side is 8 Feet; and One Horſe, by working 24 Pumps with Half the Velocity, will eaſily do 4 Times the Work of One Man.

The Engines work with a great deal of Eaſe, becauſe no Preſſure of Atmoſphere is to be remov'd; only a Velocity to be given to one Sort of Air, to change it for another.

Fire will not do in all Caſes, tho' in ſome, it will draw foul Air out of Mines with Succeſs; becauſe ſeveral Sorts of Damps extinguiſh Fire, and ſome fulminate, and are dangerous, when Fire comes near them; and even in common ſtagnant Air, Fire will not keep in long.

I am ſenſible, that large *Bellows* have ſometimes been made Uſe of for this Purpoſe; but they require a much greater Power to produce the ſame Effect, and cannot have the Advantage of being immediately chang'd from *Forcing* to *Sucking*; neither are they ſo cheap as the propos'd Engine, which may be all made of Wood, except the *Crank*, which muſt be of Iron, and the *Barrels* of very thin Copper.

VII. *A Letter to* James Theobald, *Esq*; *giving an Account of the* Norwegian Finns, *or* Finlanders, *by* Peter Kinck, *Esq*;

SIR,

INclos'd I send you an Account, the best I can collect, both from Persons of Veracity, as well as my own Observations, made in several Years Residence in the Neighbourhood of the People; which if it will be any Entertainment to you to peruse, will sufficiently answer the Pains of transcribing.

In the Kingdom of *Norway*, in those Confines which border upon *Sweden*, live a Sort of People call'd *Finns*, whose Habitation is in the Woods and Forrests, and who are some of them under the *Danish*, some under the *Swedish* Jurisdiction, of whose Original, Nature, and Manner of Life, I shall give some Account. And

I. Of their *Original*, which was from *Swedish Finland* Eastward of the Sea of *Bothnia*, from whence by Hunger, Times of Famine, and Want of the Necessaries of Life, they formerly transported themselves into *Sweden* and *Norway*, where in the Forrests and Wildernesses they got Leave to build and inhabit. For the common People of *Finland* are strong and hardy, and by Consequence fruitful and long-liv'd. *Finland* formerly was not so well cultivated as at present it is; so that the Produce of the Earth was not sufficient to subsist the Numbers of People born there; insomuch that Abundance of them (as the *Goths* and *Vandals*) were

were oblig'd to ſeek out new Quarters: And tho' theſe People have for the moſt Part kept to their native Language, yet have they made ſeveral Alterations in their Manners and Ways of living.

As for their *Language*, (tho' the much greater Part of them both underſtand and ſpeak the *Norwegian* Tongue, as well as the *Swediſh*) yet they moſtly uſe their own, which has not the leaſt Affinity or Reſemblance of either the other Two. As for Example, where the *Swedes* and *Danes*, in numbering tell 1, 2, 3. *Een*, *Toe*, *Træe*, they in theirs tell *Yx*, *Kax*, *Kolime*; and as the Firſt ſay, for Give me Bread, *Giv. mig brod*, they ſay *Alla mina leip*, &c. And when we ſtand and hear them converſe together, we are ſurpriz'd to conceive how they underſtand each other, ſince they ſpeak ſo very low, that we can ſcarce hear them.

II. Of their *Nature*. They are generally low of Stature, but ſtrong and hardy, and healthy; their Eyes are lively, their Noſes high, and their Teeth even and white, their Feet ſhort. The Women are generally ſo ſtrong of Conſtitution, that in Child-bearing they ſeldom need any Aſſiſtance, and ſoon return to the Buſineſs of the Family again, except here and there a weakly Conſtitution. They are generally ignorant and ſilly; but this muſt be attributed to the little Converſe they have with each other and the reſt of the World, ſince the *Men*, whoſe Affairs call them often to traffick with their Neighbours, and in different Provinces, are Men of good natural Parts, ſharp, and who look well to their Intereſt. They are frugal, parſimonious and humble, fearful of giving Offence, and very reſpectful to their Superiors: They will work whole Days without any Food, if they can only have Tobacco to ſmoak or chew.

III. Of

III. Of *their Manner of Life.* And this is a Subject that I could be very copious upon; but that I mayn't be tedious, what follows ſhall ſuffice. Their Food conſiſts chiefly in a Sort of Fiſh which they call *Oret*, and which anſwers to our Salmon-Trout; ('tis a very delicious fat Fiſh, which they catch in the Rivers that run thro' the Woods) and next to that, in Bread and Flour of *Rye*, which they ſometimes get great Plenty of, by cutting down and burning whole Forreſts, and ſowing the Ground with Rye, which ſometimes produces 30 or 40 Fold. But this Method of producing has been of late very ſtrictly forbidden, under very ſevere Penalties, by the Landlords of thoſe Forreſts, by Reaſon of the immenſe Dammage it does, by the Loſs of ſo much Timber; and becauſe the Fire ſometimes lays waſt immenſe Tracts of Land: So that it is with great Difficulty extinguiſh'd, burning whole Months together, to the great Detriment of Trade.

They frequently uſe *Bathing*, at leaſt once a Month, thinking thereby they prevent Sickneſs, and diſſipate all Weakneſſes from the Body: And their Method of Bathing ſeems ſo very particular, as would ſcarce agree with any other Conſtitution, or meet with Approbation from Phyſicians. The Method is this: In the Middle of the Houſe (which generally conſiſts of One large Room, built all of whole Timbers laid croſs, and notch'd in at the Ends to let them cloſe, and then caulk'd with *Moſs*, as the Seams of a Ship are with *Okam*) they build an Oven with Stone without Mortar, and without a Funnel; the Smoak going out at a Hole in the Roof, which is left open while the Wood is burning in the Oven, but ſhut cloſe as ſoon as 'tis all burnt to a bright Coal, which keeps in all the Heat. When the Oven is thus

made red hot, they then ſtrip, both Men and Women, without any Reſerve, and place themſelves on Benches made near the Roof on Purpoſe: Then cold Water is brought in, which from Time to Time is ſprinkled upon the Oven; from whence ariſes a thick Steam on the Bathers, which makes their Bodies ſo warm, that they ſweat very plentifully. Each Perſon has a Rod in their Hand, with which they gently beat their whole Bodies; and if they find themſelves ſo hot that they cannot well endure it, they call for cold Water, which they pour over themſelves in ſo dextrous a Manner, that it diffuſes its ſelf over their whole Bodies, and ſo cools them again. Thus when they have bathed ſufficiently, they go directly out into the Air, tho' in the moſt inclement Seaſon of the Year; and what is more, will roll themſelves in the Snow for a good while together, and get no Harm by ſo doing: And this Method of Bathing they make Uſe of as their ordinary Cure, when they find any Indiſpoſition of Body upon them.

In the Winter, when the Ground is cover'd with Snow, they make uſe of a Sort of long wooden Shoe, *Inducunt ſoleas ligneas tres vel quatuor ulnas longas*, on which they go ſo ſwiftly, that in 2 Hours Time they will run 13 or 14 Miles: And as they are generally good Marks-men, with their Guns they kill Abundance of wild Game, both to help to ſupport their Families, and ſell to buy themſelves Neceſſaries.

They are very ignorant of Chriſtianity, by Reaſon of their great Diſtance from any Towns; but that Misfortune the preſent King of *Denmark* has taken ſome Meaſures to remedy: Yet tho' they ſeem ſo ignorant and barbarous, yet 'tis very rare that any of them are guilty of any conſiderable Crime.

I am, &c.

VIII. *A*

VIII. *A preternatural Perforation found in the upper Part of the* Stomach, *with the* Symptoms *it produc'd, by Mr.* Chriſtopher Rawlinſon, *Surgeon.*

James Skidmore had complain'd for Three or Four Years laſt paſt, of a violent Pain in his Stomach and Bowels, never being able to reſt in his Bed at Night, 'till he had vomited up the greateſt Part of what he had eat or drank the Day before. He would often compare his Pain to ſome great Weight laying upon the Region of the Stomach, which he in ſome Meaſure alleviated, by preſſing hard with his Hand upon that Part. When he turn'd himſelf in Bed from one Side to the other, he told me, he could plainly perceive that ſome Fluid or other fell down with Noiſe to the depending Side; which Fluid he believ'd to be the Occaſion of all his Miſery: For which Reaſon he often ſaid, he would willingly conſent, nay, often earneſtly preſs'd that the Surgeons would cut him open (as he expreſſed it) and let it out.

He had no apparent *Tumour* upon the Part, nor was his Belly more *extended* than uſual. He had had the Advice of ſeveral able Phyſicians before he came into the Hoſpital, but all without the leaſt Amendment to his Diſeaſe. When he died we were deſired to open him, and try if we could find out the Cauſe of his Complaints. As ſoon as we had penetrated the *Peritonæum*, there flow'd out a whitiſh Liquor, not much unlike to *Whey*, only a little more thick and fæculent;

nor did it emit ſo noiſom a Smell as might be expected from its long Reſidence in that Place. We computed there were above Four Quarts of this Liquor contain'd in the *Cavity* of the *Abdomen*.

When we came at the *Stomach* we found it *perforated* in its *upper* Part, about the middle Space betwixt the Two Orifices, wide enough to contain the End of one's Finger. We cut it open Length-ways, and found it pretty full of a thick glutinous Matter, inclining to be yellow; and to its inner Coat, on the lower Side, there firmly adher'd the Stone of a *Prune*, or ſome other Fruit reſembling it. On its Inſide, near the preternatural Perforation, 'twas gangreen'd for two or three Inches; and on the other Side of the Perforation there was an *Ulcer* near the ſame Bigneſs. The whole Stomach was a great deal thicker than uſual; but that Part next the *Pylorus* was above Four Times thicker than in a natural State. It *adher'd* cloſely to all the Parts about it; and to the *Pancreas* 'twas ſo firmly ty'd down, that it could not be ſeparated without tearing. The Spleen did not exceed a Quarter of an Ounce in Weight. The *Pancreas* was *ſchirrous*, tho' pretty near its natural Size. In the *Liver* and *Kidneys* there was no apparent Defect; nor had the Parts in the *Thorax* receiv'd any viſible Alteration, except that the *Lungs* adher'd more firmly to the *Pleura* than uſual. The *Inteſtines* and all the *Viſcera* contain'd in the *Abdomen* were of a whiter Colour than uſual, by being ſo long ſodden in the Liquor they floated in.

IX. *An Account of an Humane Skeleton of an extraordinary Size, found in a Repoſitory at* Repton *in* Derby-ſhire, *together with ſome Examples of long Life, communicated by* Simon Degg, M. D. & F. R. S.

Extract from my Journal, Friday July *the* 15*th*, 1726.

THE Day favouring us, we ſet forward from *Derby* for *Repton*, *alias Repingdon*, and in One Hour and Two Thirds we arrived at *Repton*, a Town in the *Trent* famous for the Burial of the *Mercian* Kings, whoſe chief Seat was at *Tamworth* in *Stafford-ſhire*. This Town is likewiſe remarkable for its Free-ſchool, and its antient Abbey. Having view'd the Ruins in this Town, and enquiring for Antiquities, the Inhabitants brought us *Thomas Walker*, a Labourer, aged Eighty Eight Years, who gave the following Account.

About Forty Years ſince cutting Hillocks, near the Surface he met with an old Stone Wall, when clearing farther he found it to be a ſquare Encloſure of Fifteen Foot: It had been covered, but the Top was decayed and fallen in, being only ſupported by wooden Joyces. In this he found a Stone Coffin, and with Difficulty removing the Cover, ſaw a *Skeleton* of a *Humane Body Nine Foot* long, and round it lay *One Hundred* Humane Skeletons, with their Feet pointing to the Stone Coffin. They ſeem'd to be of the ordinary Size. The Head of the great Skeleton he gave to Mr. *Bowers*, Maſter of the Free-ſchool. I enquired of his Son, One of

of the preſent Maſters, concerning it, but it is loſt; yet he ſays, that he remembers the Skull in his Father's Cloſet, and that he had often heard his Father mention this Gigantick Corps, and thinks this Skull was in Proportion to a Body of that Stature. The Bottom of this Dormitory was pav'd with broad flat Stones, and in the Wall was a Door-caſe, with Steps to go down to it, whoſe Entrance was Forty Yards off, nearer the Church and River. The Steps are Stone, and much worn: 'Tis in a Cloſe, on the North Side of the Church, and over this Repoſitory grows a Sycamore, planted by the old Man when he filled in the Earth. The preſent Owner will not ſuffer it to be open'd, the Lady of the Mannor having forbidden it. This was atteſted to us by ſeveral old People, who had likewiſe ſeen and meaſured the Skeleton.

EXAMPLES *of Long Life.*

AT *Uttoxeter*, in the Moorlands of *Stafford-ſhire*, were buried the following Number of People at the following Ages, in the Year 1702.

In 14 Days were buried Three Women, the Firſt 103, the Second 126, and One of 87; and the ſame Year Two Siſters and a Brother in and of that Pariſh, the Brother 92, the youngeſt Siſter 95, the eldeſt Siſter 98.

And in the ſame Pariſh this preſent Year 1726, were buried in 22 Days, the following aged People.

Auguſt the 7th One Woman aged 94, and One Man aged 81.

Auguſt the 4th One Man, aged - - - - 68

Auguſt the 19th One Man, aged - - - - 87

Auguſt

Auguſt the 22d One Man, aged - - - - - 82
Auguſt the 23d One Man, aged - - - - - 83

Men 4
Women 2

In 1726. at *Gravely* in *Hertford-ſhire*, 31 Miles from *London*, almoſt every Sixth Soul is upwards of Sixty. Inhabitants 187. aged above Sixty, 29.

X. *A farther Account of the Bills of Mortality*, &c. *of ſeveral conſiderable Towns in* Europe, *for the Years* 1722 *and* 1723, *extracted from the* Acta Breſlavienſia, *by Sir* Conrad Spengell, R. S. S. & Col. Reg. Medic. Lond. Lic.

A Liſt of thoſe that were born and buried, &c. *in* Breſlaw, &c. *in the Year* 1722.

	Buried
From the 25th of *Dec.* to the 31ſt, 1721.	35
January, 1722.	100
February,	94
March,	129
April,	121
May,	122
June,	182
July,	185
Auguſt,	203
September,	167
October,	173
November,	190
December, 'till the 24th	90
	1791

Chriſtened	
Males	665
Females	670
	1335

Married 424 *Pair.*

Among the Dead were		
Married Men		231
Married Women		149
Widows and Widowers		150
Batchelors		57
Maidens		52
Children to 10 Years of Age	Boys	570
	Girls	499
Still-born	Boys	53
	Girls	30
		1791

In

In *Vienna*

Buried,

Men,	1038	Among which was, 1 of 105, 1 of 110,	
Women,	942	and another of 111 Years of Age.	
Boys,	1551	*Chriſtened*	
Girls,	1430	Children, - - - - - - -	4417
	4961		

In *Dreſden*,

Buried 1519, *Chriſtened* 1514, *Married* 451 Pair.

In *Leipſig*,

	Buried									Chry-ſoms	Still-born			
	Married Men	Married Women	Batchelors	Maidens	Boys	Girls	Child-bed-Women	Males	Females	Males	Females	Widowers and Widows	*Summa*
January	13	6	9	4	20	23	3	4	0	5	3	11	101
February	17	11	11	8	14	7	0	3	3	4	2	13	93
March	10	6	3	4	21	11	3	9	1	6	2	8	84
April	19	9	4	10	17	8	1	3	3	1	2	15	92
May	19	13	13	2	20	14	2	5	2	2	4	15	111
June	11	7	4	2	22	26	0	4	2	5	5	1	89
July	11	8	4	2	24	22	3	4	3	3	2	3	87
Auguſt	8	5	6	8	16	9	1	4	3	2	4	2	68
September	8	3	1	1	19	14	1	3	2	1	2	6	61
October	6	9	4	5	12	8	1	6	1	3	6	4	65
November	11	7	3	3	10	14	1	7	0	1	2	5	64
December	11	7	4	4	19	13	0	6	3	4	2	6	79
Summa	144	91	66	53	214	169	16	58	23	35	36	89	994

Chriſtened

Chriſtened

	Males	Females	Total	Pairs Married
January	44	21	65	25
February	30	26	56	21
March	36	31	67	29
April	39	28	67	0
May	39	41	80	53
June	40	35	75	23
July	40	39	79	55
Auguſt	40	34	74	27
September	34	43	77	22
October	49	30	79	24
November	33	38	71	76
December	39	39	78	6
Summa	463	405	868	361

So that in this Year there died 994, and Chriſtened 868. Hence there are 126 fewer born than died.

Among the Chriſtened were
2 Poſthumous,
12 Twins,
99 Baſtards,
1 Foundling.

Among the Dead were

78 from 60 to 69 Years old,
50 70 79
15 80 98

In Weimar,

Buried 143, *Chriſtened* 190. Among the latter were 107 Boys and 83 Girls, and among theſe were 6 Twins and 1 Baſtard. 73 Pair were married.

In Berlin,

Buried 2499, *Chriſtened* 2701. Among which were 260 Baſtards. *Married* 742 Pair. So that there were 202 more *born* than *buried.*

The Special LIST *of the Kingdom of* Pruſſia.

	Chriſtened	Pairs Married	Buried
IN *Angerberg* - - - - -	565	92	212
Balga - - - - - - -	604	145	400
Bartenſtein - - -	268	42	124
Barthen - - -	309	97	170
Brandenburgh - -	937	223	546
Dutch Elau - -	157	20	54
Fiſhauſen - -	473	105	405
Gerdauen - -	545	92	187
Gilgenburg - -	205	63	98
Inſterburg - -	2047	381	1013
Johannisburg - -	382	68	191
Labiau - -	608	99	280
Liebſtadt - -	443	76	179
Lotzen - -	263	57	110
Lyck - -	360	93	119
Marienwerder - -	791	185	398
Mummel - -	913	225	521
Neydenburg - -	674	153	301
Neuhauſen - -	217	62	141
Neuhoff - -	37	2	25
Oletzko - -	726	123	270
Ortelsburg - -	501	91	260
Oſterode - -	506	97	207

In

	Christened	Pairs Married	Buried
In *Preuſs Elau* - -	490	96	276
------- *Holland* - -	666	147	334
------- *Marck* - -	142	170	287
Ragnit - -	803	109	371
Raſtenburg - -	553	118	301
Rein - -	551	81	174
Schacken - -	524	130	390
Schonberg - -	279	66	114
Seheſten - -	356	76	137
Tapiau - -	846	176	401
Tilſit - -	1267	218	632
The Cities of *Koningsberg*	1664	442	1688
Total	20672	4420	11316

In *Cuhrmarck Brandenburg*	18334	4732	11602
Neumarck - -	7509	1705	4047
The Dukedom of *Magdeburg*	8402	2264	6006
of *Cleve* and *Mark*	6921	1886	5740
Pomerania	7256	1858	4424
Halberſtadt	2899	724	2040
Hohenſtein	589	151	403
Minden	2140	479	1351
Ravensberg	2270	605	1600
Mors	491	160	369
Geldern	1686	447	1449
Tecklenburgh	579	118	398
Lingen	729	242	529
Lauenberg and *Butow* -	630	156	372
French Colonies - -	663	130	572
Of all the King of *Pruſſia*'s Dominions — Summa	81770	20077	52218

So that there were 29552 more *Christened* than *Buried.* Among the *Dead* were 71 above 90 and 100 Years of Age; and One of 120.

In *Nurenberg,*

Buried,		*Born,*	
Married Men, -	194	Males, - -	501
Women,	233	Females, - -	554
Batchelors, - -	42	*Summa*	1055
Maidens, - -	61		
Boys, - -	285	Among which were 12 Twins.	
Girls, - -	230		
Still-born, -	12		
Summa	1057		

In *Copenhagen,*

Born,		*Married,*	*Buried,*
Males,	1345	785 Pair.	1999.
Females,	1256		
	2601		

So that there were 602 more born than buried.

In *Amsterdam Died* 8421.

In *Epperies* were *Born*	213	*Buried*	135		
In *Dantzig* were *Born*	2092	*Married*	490 Pair.	*Buried*	1442
In *Rawitz* were *Born*	200	*Buried*	74		

The

The Bills of Mortality of the Year 1723. from the Acta Breslavienſia.

In *Breſlaw*,

From the 25th of *Dec.* to the 31st, 1722.	*Buried* 22	*Chriſtened*	
January, 1723.	118	Males	711
February,	114	Females	684
March,	122		1395
April,	102	*Married* 422 *Pair.*	
May,	115	Among the Dead were	
June,	119	Married Men	220
July,	93	Married Women	118
Auguſt,	124	Widows and Widowers	150
September,	124	Batchelors	48
October,	85	Maidens	46
November,	114	Children to 10 Years of Age: Boys	369
December, 'till the 24th	69	Girls	306
	1321	Still-born: Boys	38
		Girls	26
			1321

In *Vienna*,

Buried 5443. Among which were 1079 Men and 974 Women, 1758 Boys, and 1632 Girls. *Chriſtened* 4457.

In *Lobau*,

Buried 171. *Chriſtened* 226, and 70 Pair *Married.*

In

In *Freyberg*,

Buried 321 *Chriſtened* 362

In *Dreſden*,

Buried 1654. That is, 165 Married Men, 136 Married Women, 36 Widowers, and 138 Widows, 68 Batchelors, 64 Maidens, 580 Boys, and 467 Girls.

Still-born, Boys 54 and Girls 46. *Chriſtened* 1510. That is, 756 Boys and 754 Girls. Among which were *Baſtards* 66 Boys and 41 Girls. *Married* were 396 Pair.

In *Leipſig*,

Buried 928. Among which were 126 Married Men and 88 Married Women, 53 Batchelors and 36 Maidens, 199 Boys and 164 Girls, 21 Women in Childbed, New-born Boys 60, and Girls 46, beſides Still-born Boys 37, and Girls 30; alſo 68 Widows and Widowers. *Chriſtened* were 966; as 489 Boys and 477 Girls Among which were 11 Pair Twins and 99 Baſtards. *Married* have been 306 Pair.

In *Erfurt*,

Buried 448, *Chriſtened* 666.

In the Elector of *Mentz*'s Dominion, in 75 Villages are *Buried* 543, *Chriſtened* 872.

In *Berlin*,

Buried 2618, *Chriſtened* 2770. Among which are 289 Baſtards.

In

In the Towns and Villages of the *Old*, *Middle*, and *Uckermark* are *Chriſtened* 19058. Among which are 995 Baſtards. There were *Married* 4943 Pair, and *Buried* 13317. Among which were 23 who lived to 90, 100, and One to 112 Years old. So that there were 5741 more Born than Buried.

In the reſt of the King of *Pruſſia*'s Dominions.

	Born	*Married*	*Buried*
In the Kingdom of *Pruſſia*,	21384	4957	10762
In the Elect. of *Brandenburgh*,	18774	4863	13015
In *Neumark*, - -	6907	1813	4193
In the Dutchy of *Magdeburg* and County of *Mansfeld*, - - - -	8858	1781	5579
Cleve and *Mark*, - -	6645	1924	6848
Pommern, - - - -	8544	2241	5294
Halberſtad, - - -	2943	808	2162
Hohenſtein, - - -	604	165	389
Minden, - - -	2087	565	1925
Ravensberg, - -	2061	613	1833
Moers, - - -	484	156	371
Geldern, - - -	1866	436	1478
Tecklenburg, - -	475	141	437
Lingen, - - -	701	270	641
Lauenberg and *Butow*, -	588	149	340
French Colonies - -	594	177	563
	83515	21059	55830

Among the *Born* are 2157 Baſtards, and among the *Buried* 77 that were above 90 and 100 Years old. So that there were 27685 more Born than Buried.

In

In *Copenhagen* were *Born* 2604, *Buried* 1914, *Married* 701 Pair. Therefore 690 more Born than Buried.

In *Amsterdam* there *Died* 7119, and were *Married* 2289 Pair.

In *Epperies*, *Born* 203, *Died* 132.

In *Dantzig*, *Born* 2002, *Buried* 1495, and *Married* 537 Pair.

I have but just got the *Acta Breslavienſia*, or elſe would have ſooner ſent this.

Adieu, &c.

XI. *Ingens Materiæ Purulentæ copia cariem & ſeparationem totius* Oſſis Mali, *&c. inducens, & per triennium ex Ore Pueri defluens, obſervata à Domino* Petro Hardiſway, M. D.

DIE Sexto Menſis Febr. 1724. advocabar ad Puerulum decennem, qui à ſex ſeptimanis febre lentâ decumbebat malè multatus. Præſcriptis quæ res poſtulabat remediis, intrà ſex vel ſeptem dierum ſpatium à morbo liber evaſit: Verùm diebus aliquot elapſis, ingens in Genæ dextræ interioribus ſubortus eſt Tumor, puero nihilominùs, quoad cætera benè valente. Ore ejus ægrè diducto, in conſpectum veniebat ingens Puris quantitas, at unde manaret, præ Pueri protervià non licuit pro hâc vice explorare. Ideò conſulebam tantùm, ut ficum in lacte coctam ad tumorem emolliendum, atq; ſi fieri poſſet rumpendum admoverent. Mane ſequenti Os incredibili ferè Puris copiâ, teterrimi odoris (tumore intereà diſrupto) diffluebat. Gargariſmate modicè detergente præſcripto, circà veſperum Pus pari omninò quantitate

quantitate atq; priùs depluebat. Mirabar ſanè unde hoc provenire poſſet, cùm Ulcus in Genâ tanto proventui nequaquàm ſufficere videretur; ſuſpicabar autem (fœtore præ cæteris ſuadente) materiæ iſtius fontem in capite alicubi intrà oſſa latitare: quod cùm paulò diligentius inveſtigarem, ecce *Os Maxillæ ſuperioris ad dextras* carne (quæ quaſi ſemicocta utrinq; receſſerat) denudatum prorſùs atq; *Carie* correptum, & ex *Dentium Alveolis* (dentes enim puerulus, ceu inutiles, ſuis nullo negotio jam extraxerat digitis) hoc materiæ purulentæ profluvium jugiter delabi: quapropter Chirurgus è viciniâ advocatus eſt, cui committebatur negotium. Huic ſuadebam, ut dum *Oſſis* medelæ incumberet, *Ulceris* itidem deterſioni & conſolidationi operam daret; verùm quicquid dicerem, nulla quæcunque Genæ ſuppuratæ adhibere voluit medicamina: quo factum eſt, ut ea iterum in molem ingentem, atq; alterâ (ſiniſtrâ ſc.) duplò major citò excreſceret. Mandibulæ Carioſæ ſolummodò penicillum tincturâ quâdam, forſan *Myrrhæ*, imbutum applicabat. At longo temporis ſpatio tandem emenſo, cùm parùm ſuâ tincturâ proficeret, hamulo admoto, quod temporiùs factum debuerat, *Os Mali* integrum evellebatur. Ab Oſſis extractione Gena nequicquàm ſubſidebat, ſed potiùs incrementum ſumebat, & materiæ purulentæ copia nullatenùs minuebatur. Oſſe autem abrupto, *Oſſis Palati* dimidium cum *Narium Septo* abſumptum eſt; parte etiam infimâ *Orbitæ oculi* ſimul abreptâ, ut in Iconibus adjectis clariùs oſtendere ſim conatus. His addendum, quod Tumore *Proceſſui Zygomatico* ſuperſtiti incumbente, *Gena* mole duplò inſignior *ſiniſtrâ* extat, & oculum pœnè claudit, pure quaſi ex fonte perenni indeſinenter fluente.

Fig. 1*ma.* Facies Oſſis externa.

a, a, a, a, a. *Alveoli* Dentium.

b. Dens *molaris* remotior.
c. Pars *Orbitam* oculi faciens.
d. Pars Oſſis ubi abruptum circà *Naſum.*
e. Pars Oſſis ubi *Proceſſus Zygomaticus* terminatur.
f. Pars Oſſis ſub *Labium ſuperius.*

Fig. 2*da.* Forma interior Oſſis.
1 Pars ad *Naſum* abrupta.
3 Pars *Mandibulæ* exterior & Dentis *alveolus.*
4 Pars Oſſis *oculum* attingens.
5 Pars *Maxillæ* remotior.
6 Pars *Naris dextræ, ſepto* abrupto.
7 Dens *Molaris.*

Fig. 3*tia.* Os reſupinatum exhibet.
D, D, D, D. Pars *Oſſis Palati.*
E, E, E. Alveoli dentium.
F, F. Pars *Mandibulæ exterior.*
G. Pars *anterior* ejuſdem.
H. Dens Molaris.

Fig. 4*ta.* Facies interior Oſſis parùm reclinati.
A, A, A, A. Pars *Mandibulæ*, & *Alveoli* Dentium.
B. Locus ubi os abruptum circà *Naſum.*
C. Pars oſſis *Oculum* attingens.
D. *Maxillæ* pars remotior.
E. *Dens Molaris* remotior.
F. Pars *Oſſis Palati.*
G. Pars *Naris dextræ, ſepto* abrupto, ut in Fig. 2da. N°. 6.

Poſt hæc, idem vir peritiſſimus per Literas die 24. Decemb. 1727. datas, *Editorem* certiorem fecit, "Tumorem ſuprà deſcriptum in eodem adhuc remanere ſtatu, "Materiâ Puriformi Os & Fauces prò ſolito irrigante. "Puer cætera ſanus edit, bibit, dormit, & unà cum "aliis ſuæ ætatis quotidiè alacriter ludit.

F I N I S.

ERRATA. No. 399. Pag. 294. lin. 11. lege *pyri-inciſis.* Ibid. l. 19. leg. *latifolia.* P. 303. l. 19. leg. *are.* P. 315. l. 23. leg. *Curienſis.* P. 317. l. 11. leg. *cuticula.* P. 324. l. 17. leg. *ſame.* Ibid. l. 26. leg. *animals.*—— No. 400. P. 351. l. 7. leg. *caſes.* P. 354. l. 9. leg. *horizontal.*

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